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ROYAL BOTANIC GARDENS, KEW.

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XXIII.—CONIFEROUS TIMBERS.

The European Pines; their Commercial Importance and their Relationship to British Forestry.

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Nine species of the genus *Pinus* are natives of Europe, one of them being found wild in the British Isles. They are not all confined to Europe, however, for several occur also in Asia, the cold-resisting kinds extending into Siberia, whilst some of the southern species are found in Asia Minor. *P. canariensis*, from the Canary Islands, may also be included in the group, for so far as geographical affinities are concerned, it can be dealt with more appropriately here than with either the Asiatic or American species.

The species are:—

P. Brutia, Tenore.
P. canariensis, C. Smith.
P. Cembra, Linnaeus.
P. halepensis, Miller.
P. Laricio, Poiret.
P. montana, Miller.
P. Peuke, Grisebach.
P. Pinaster, Solander.
P. Pinea, Linnaeus.
P. sylvestris, Linnaeus.

They vary a good deal in habit, and also in their economic importance. Some grow into large trees 100–150 feet high, whilst others are medium-sized trees or even shrubs, and, although some species are included amongst the most important coniferous timber trees, little more than local value is attached to other kinds. Similar remarks are applicable to their use in forestry, for although three or four species are planted extensively either in the British Isles or on the Continent, the usefulness of others is confined to certain positions where local conditions demand particular species.

P. Brutia, *Tenore.*—*P. pyrenaica*, Lapeyr., *P. halepensis* var. *Brutia*, Calabrian Pine, Pin Mazaron and Pin Pinceau.

This is found wild in south-eastern Europe and in Asia Minor, especially on the Taurus and Lebanon Mountains. In general appearance it is very like *P. halepensis*, but differs in the direction taken by the cones; in *P. Brutia* they point forwards,

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and in *P. halepensis* backwards on the branches. For other particulars see *P. halepensis*. It was introduced to the British Isles in 1836, but is of no great importance here either for ornament or profit. Elwes and Henry, "Trees of Great Britain and Ireland," V., p. 1103, refer to its being planted in Afghanistan and Persia, but it does not appear to have been used to any great extent for forest planting. The timber is said to be of good quality, and to be used for general carpentry work in the eastern Mediterranean region.

P. canariensis, *C. Smith.*—Canary Pine, Téa Wood.

This is a large-growing tree, native of the Canary Islands, where it still forms forests in La Palma (Sprague and Hutchinson, *K.B.*, 1913, p. 294), although many large areas have been denuded of trees. Its leaves are often about 6 inches long, sometimes much longer, slender, very glaucous on young plants, produced in bundles of three leaves each enclosed at the base by a sheath about $\frac{3}{4}$ inch long. The cones vary in size, often being as much as 9 inches long and 3 inches wide, bright brown in colour. They remain on the branches for several years without liberating their seeds, and point towards the base of the branch upon which they are borne. The wood is used largely for building purposes in the Canary Islands, but the supply is not plentiful enough for its influence to be felt upon the timber market. Heart-wood and sapwood are very distinct, the former being known as téa wood and credited with great durability. A section in Museum No. III. at Kew, contributed by Mr. A. K. Bovill in 1901, was taken from the beam of a wine press at Garrachico, Tenerife, which was built more than two centuries ago and had stood out in the open during the whole of that time. The wood is now perfectly sound and very heavy (68 lbs. 3 oz. to the cubic foot). It has a somewhat similar appearance to the heart-wood of *P. Laricio*, and is peculiar from the fact that the rings of autumn wood are almost as wide as those of the summer wood. *P. canariensis* is not hardy in the British Isles, but it has been found useful in S. Africa and elsewhere for sylvicultural purposes.

P. Cembra, *Linn.*—Swiss Pine, Swiss Stone Pine, Alpine Pine, Arolla Pine, Siberian Pine, Siberian Cedar, Pin Alviez, Pin Tinier.

This species inhabits two distinct regions, the Alps of Central Europe and N. E. Russia and Siberia. Loudon established two varieties, calling the one from Central Europe *helvetica* and the other *sibirica*. The first name fell into disuse long ago, but the other is still used as the Siberian tree is considered to be taller and of more rapid growth with a denser and more pyramidal outline than the other, but there the distinctive characters cease, and for all practical purposes the trees from both regions are identical.

The easily recognised characters of *P. Cembra* are its pyramidal outline when young; close growth with a dense brownish pubescence on the younger shoots; dense leafage, the leaves being dark green with two greyish lines on the inner surface, up to 4 inches long, arranged in bundles of five, and often retained for

four or five years; rather large, persistent, brown scales about the bases of the leaves; and short, thick, ovoid cones, 2 to 3 inches long, which do not open and liberate the seeds when ripe as is the case with other five-leaved pines. The cones usually fall intact, and the seeds are liberated by the rotting of the scales or by birds or animals in search of food.

In Central Europe it is usually met with at altitudes of 5000–7000 feet, and in various parts of Switzerland it is used up to 8000 feet for protective works, where the cold and exposure is too severe for common spruce and Scots pine. Under favourable conditions it attains a height of 70–80 feet, with a trunk diameter of 1½–2 feet. Isolated trees may sometimes be much larger in girth, and Elwes and Henry, l.c. pp. 1037–8, refer to a tree growing at Muotta da Celerina near Pontresina at an elevation of 2120 metres which measures 15 to 16 metres in height with a girth of 4·20 metres, and another tree growing behind the Findelen Hotel on the Riffel Alp is recorded as being 25 feet in girth. The last example has been estimated to be between 1000 and 1100 years old. The species is conspicuous on the Swiss Alps between St. Moritz and Pontresina. When growing in close woods a considerable portion of bare trunk is found, but whenever the trees are but moderately dense side branches occur quite low on the trunks. The timber is often very knotty, the knots measuring 1–2 inches in diameter, but it has a good reputation for strength, and the better qualities are in demand for structural work. Very knotty wood is sometimes cut into boards and used for panelling rooms, either quite plain or varnished, whilst clean wood is valuable for carving. In Eastern Russia and Siberia it grows 120–130 feet high with a clear trunk of 60–80 feet, and the timber is said to be less knotty than that grown in Switzerland. There is an export business in this timber from some of the North Russian ports. In both Siberia and Switzerland the seeds are used for food.

Although *P. Cembra* was introduced to the British Isles in 1746 really fine examples are uncommon, very few specimens being on record which have attained a height of 70 feet or more. As a young tree it is much used for ornamental planting, but it does not give entire satisfaction in the south and rarely bears cones freely. In Scotland it cones regularly, but even there it does not appear to have a commercial future. Experimental plantings have been made here and there, notably at Balmoral, but so far the results do not appear to warrant extensive plantations. It is possible that throughout the British Isles it misses the decided winter's rest that it gets in a state of nature.

Planks from ornamental trees grown in this country show the knotty character which is often such a pronounced feature of Swiss wood. A thoroughly dry specimen of the wood in Museum No. IV., grown in Lincolnshire, weighs 27 lb. to the cubic foot.

P. halepensis, *Miller.*—Aleppo Pine, Jerusalem Pine, Pin Blanc, Pin d'Alep, Pin de Jerusalem.

This species was introduced to the British Isles by Bishop Compton in 1683, but owing to the climate it has not become a

common tree. Possibly the best example in the country is growing in Miss Talbot's garden at Margam, S. Wales; it exceeds 70 feet in height and is 10 feet 1 inch in girth at breast high. Under favourable conditions in its native country it is said to attain a height of 80 feet with a girth of 12–14 feet, and to have an average life of 250 years. It is widely distributed through the Mediterranean region from Spain to Asia Minor, N. Africa and the Mediterranean Islands. In its eastern range it is mixed with *P. Brutia* and *P. Laricio*, and in the west with the latter species and *P. Pinea*. According to Elwes and Henry, l.c. p. 1101, it grows as a timber tree in the Balearic Isles up to 3200 feet; and 700 feet higher it is a mere bush. It is found in forests of considerable extent, particularly on the Island of Iviza, where it is the chief component of a forest of 16,000 acres. In Cyprus it is said to be a finer tree than *P. Laricio*.

It has given satisfactory results for sylvicultural purposes in certain warm temperate countries where the rainfall is limited, as, for instance, S. Africa and Spain. H.M. Consul at Malaga, "Diplomatic and Consular Report, No. 4360," 1908, Annual Series, pp. 13–14, refers to its successful planting on poor, waste, sandy land on the shores of the Mediterranean to the east of Malaga. Year-old plants were planted from pots. After two years in the ground they were 4 feet high; after three years in the ground they were 7 feet high and 3 inches in diameter, whilst those that had been planted five years were from 11½–13 feet high and 5–5½ inches in diameter. The rainfall for the year 1908 was 8½ inches.

The principal distinguishing characters of *P. halepensis* are, young shoots glaucous green; terminal buds ⅓–½ inch long; leaves in pairs enclosed by a short sheath which persists until the leaves fall, usually at the end of the second year, slender, dark green, 2½–4 inches long; cones solitary, in pairs, or in whorls of three, 2½–3 inches long, conical, broad at the base, narrowing rather rapidly towards the apex and pointing towards the base of the branch on which they occur; they usually remain intact upon the branches for several years. The timber has a good reputation and is used extensively for general work in the Mediterranean region.

P. Laricio, *Poiret.*—Corsican Pine.

This important species is widely distributed in S. Europe from Spain to the Crimea and Caucasus and in Asia Minor to the Taurus Mountains. It varies a good deal in habit, particularly in height and in the density of the branch and leaf systems, and there are several distinct varieties. The typical Corsican tree is 120–150 feet in height with a girth of from 12–20 feet. Young trees in this country are usually very straight with the whorls of branches widely separated, often 1½–2 feet apart, the branches being small in diameter and comparatively short, so giving the trees a fastigiate appearance. The heads of old trees, however, have a distinct tendency to widen and become flat. The leaves are in pairs, dark green, 4–6 inches long, remaining on the tree 3 or 4 years, enclosed by a sheath ½ inch

long, which remains intact until the leaves fall; cones small, 2–3 inches long, little more than an inch wide, opening and shedding their seed the spring after they ripen; winter buds ½–1 inch long.

It is said to have been introduced to the British Isles about 1759, and a fine old tree a century old is to be seen near the Main Gate at Kew. This tree is 95 feet high and 9 feet 5 inches in girth at 5 feet above the ground. There are also fine examples in other parts of the country, notably at Holkham Hall, Norfolk. On the Holkham Estate, the Corsican pine has been used for more than half a century for planting on sand dunes quite close to the sea, and it has been found to be an excellent subject for the purpose; not only has it grown well in exposed places, but it has reproduced itself in quantity from self-sown seeds. Unfortunately the wood matures very slowly, little heart-wood being formed until the trees are approaching their full size. A transverse section of timber in the Kew Museums, which was grown in Hungary, measures in different directions 2 feet 1½ inches and 2 feet 4 inches in diameter, and shows 246 annual rings. The heart-wood is irregular in outline, but at its greatest width only measures 16½ inches, in another direction it measures 13½ inches across, the annual rings of heart-wood in one case numbering 104 and in the other 82. The heart-wood is a deep reddish-brown and the sap-wood is yellowish in colour. Fast grown timber from Holkham is shown in Museum No. IV. at Kew. A plank 2 feet 3¾ inches wide, showing 53 annual rings, has only 9 inches of heart-wood, and that is confined to 13 years' growth. The same peculiarity has been noticed in other places notably in Yorkshire on Lord Wharncliffe's Wortley Hall Estate, where about 1,000,000 Corsican, and the closely allied Austrian, pines have been planted. When the original plantations were formed it was thought that the thinnings could be disposed of profitably in the neighbourhood for pit props, but when at the age of 17 years a thinning was undertaken, the timber was condemned for props because of lack of heart-wood and the necessary strength, *K.B.*, 1910, p. 14. The Corsican pine has also been planted extensively in North Wales, where it grows rapidly, but is disposed to produce rather coarse timber. The best piece of British grown Corsican pinewood in the Kew Museums is a small section cut from a branch of the old tree at Kew. Its close annual rings indicate slow growth and there is a good development of heart-wood. That particular specimen weighs, excluding fractions, 41 lbs. a cubic foot, and a specimen from Holkham grown on the sand dunes weighs 31 lbs. a cubic foot. Timber grown in the Mediterranean region has a good reputation and is in considerable demand there for general constructive work and other uses for which good pine timber is required. It would, therefore, appear that the tree is well worth planting widely in poor soils and in exposed situations, particularly near the sea, and in positions where it can be grown on a long rotation system, or in places where it can be marketed in a young state for inferior kinds of work, but it would be little use to expect first-rate prices for young, fast-grown trees. In

natural forests the tree is considered to be at its best for felling between 250 and 300 years of age. Moderately close planting is advisable, for trees grown wide apart are inclined to produce coarse timber. A point which is strongly in favour of the extended planting of Corsican pine is its practical immunity from attack by rabbits. The species has been tapped for resin, but with little success in comparison to other kinds. Next to the Scots pine it is the most profitable pine to plant under forest conditions in this country.

P. Laricio var. **nigricans,** *Parl.* (var. *austriaca Endl.*).—Austrian Pine.

Of the several varieties of *P. Laricio* this is most widely grown. It is easily distinguished by its dense branch system and heavy leafage, the leaves remaining on the trees for 4 or 5 years. It produces coarse timber of little value in this country, but is invaluable for purposes of shelter and is often used for protection in exposed positions. The branches are retained to the ground line, and trees which are exposed to the full fury of winds direct from the sea develop as sturdy, heavily-branched bushes or small trees, forming excellent protection for more useful timber trees in the background.

P. montana, *Miller.*—Mountain Pine.

This is a low-growing bushy species from the mountains of Central and southern Europe. It varies a good deal in habit, but is usually from 3–12 feet in height. A small economic value attaches to it as a source of pine oil, but its principal value to the forester is for planting on exposed land at a high elevation to provide shelter for young trees of more important species. The variety *uncinata,* however, has some value as a timber tree. It is found in the eastern and central Pyrenees, the French Alps, and in restricted areas in Switzerland, as a tree often 60–80 or sometimes 100 feet high, with a girth which may be as much as 8 or 9 feet. In the Pyrenees it occurs at elevations of 5000–8000 feet and withstands a considerable amount of wind and cold. For this reason it is being planted in exposed positions in the Highlands of Scotland where other trees fail.

P. montana produces its leaves in pairs. They are 2–2½ inches long, arranged closely on the branches and are enclosed at the base by a short sheath. The cones are from 1–2 inches long and rarely more than an inch wide.

P. Peuke, *Grisebach.*—Macedonian Pine.

This has been spoken of as the European counterpart of the Bhotan pine or Himalayan blue pine (*P. excelsa,* Wall.), but the two trees are distinct in general characters. Its region of distribution is almost limited to Macedonia, Bulgaria, and Montenegro. Elwes and Henry, l.c., p. 1015, refer to it as growing 100 feet high with a girth of 5–7 feet in Bulgaria, but its average height appears to be 70–80 feet, a height that it will probably attain in the British Isles, although it is of slower growth than several other European pines. Its branch system is more compact than that of *P. excelsa,* and the tree has a stiffer and more

pyramidal outline. The leaves are borne in bundles of five and remain in good condition for about three years. They are usually about 4 inches long, stiffer in appearance than those of *P. excelsa*, and densely arranged about the points of the branches. The cylindrical cones are 4–6 inches long and 1½–2 inches in diameter, resinous, expanding when ripe and liberating the seeds, but remaining on the trees for several months afterwards. It agrees with *P. excelsa* in having the young wood shining and glabrous.

Although it grows fairly well as an ornamental tree in this country it does not appear to have been tried for forest planting. In some Continental countries, however, there seems to be a disposition to substitute it for the Weymouth pine (*P. Strobus*, Linn.) where the latter tree suffers from the attacks of pine aphis. The timber of *P. Peuke* is used for building purposes in its native country, but it does not affect the timber market elsewhere.

P. Pinaster, *Solander.*—Maritime Pine, Seaside Pine, Cluster Pine, Pin à Trochet, Pin de Bordeaux, Pin des Landes, Pin Grand, Pin Maritime, Tree of Gold.

This species is widely distributed in the Mediterranean region from Spain to Greece, where, under the most favourable conditions, it forms a fine tree 100–120 feet high with a girth of 12–14 feet. It is conspicuous by reason of its thick, reddish-brown bark, long, stout leaves, and large, woody cones. The leaves are in pairs, each 5–6 inches long, enclosed at the base by a sheath up to an inch in length which remains intact during the life of the leaves, usually about three years. The mature cones are bright brown, 4–7 inches long and 1½–2½ inches wide, often remaining unopen upon the tree for several years after the seeds are ripe. They may be borne singly, two or three together, or in large clusters. Although the timber is not of a first-rate quality, it is used for building purposes, street paving, railway sleepers and telegraph poles, and is in great demand for pit props. Perhaps the chief economic use of the tree, however, is as a source of resin and turpentine, French resin and turpentine being derived largely, if not entirely, from this species. It is used in the manufacture of artificial camphor, colours, etc., and the dry products principally in the manufacture of soap, paper, varnishes, linoleum, electric cables, distillation of oils and other purposes.

It grows well in various parts of England, particularly in the southern maritime counties, where it withstands considerable exposure to winds. Numerous finely developed trees are to be found on exposed cliffs at Mount Edgcumbe, whilst shelter provided by this tree and *Cupressus macrocarpa* makes it possible to cultivate many tender exotics successfully in the Scilly Islands. It has been planted on sand dunes in some places, and a vigorous young plantation exists quite close to the shore on the Margam Estate near Port Talbot. When fully exposed to rough winds it develops with a dense, bushy habit, height growth being comparatively slow, but where the effects of shelter are felt, fairly rapid growth in height is maintained.

In south-west France the value of this species is well known, and the story of the conversion of an almost barren tract of land

into valuable forest is full of interest. The present area of the forests of maritime pine in this region is computed to be about 2,500,000 acres; in 1892 it was given as 1,715,000 acres, and in 1855 as 50,000 acres. The value of the forests in 1904, according to Mr. Huffel, was £18,000,000; the annual revenue obtained by the sale of timber, turpentine and resin being £560,000, or 7s. per acre. Owing to recent improvements in transport, such as construction of light railways, the annual returns have considerably increased.*

Recent particulars of the forest area have been given by Mr. Consul Rowley in his Report on the Trade and Commerce of the Consular District of Bordeaux for the year 1912,† from which the following extracts are taken:—

"The area covered at the present time by pine forests in south-west France is about 2,500,000 acres. According to the age of the trees the land is valued at from £4 15s. 6d. per hectare ($2\frac{1}{2}$ acres) for two-year old trees to £76 per hectare for trees 40 years old, and £80 per hectare for trees 70 years old. In the year 1835 the same land was worth about 30s. per hectare.

"In the early part of the Nineteenth Century this area, more especially that part known as the Landes, was nothing more than a marshy, partly treeless waste, covered with a low dense growth. It was originally damp, unhealthy and sparsely inhabited on account of the immense sand dunes lined up along the shores of the Bay of Biscay, which, due to their constant trend inward, swallowed up trees, villages and forests, and obstructed the rivers and inlets. Water could not drain away and in the end flooded large areas, which turned into stagnant, pestilential fever marshes. The damage by the moving sand became so bad that the Government officials had to devise and execute plans for reafforesting the whole area. The ownership of the land is divided into three groups—1. Belonging to Government. 2. Belonging to departments or townships. 3. Belonging to private owners.

"The forests belonging to the State are divided into 15 sections and are very carefully worked.

"In the first section are placed seedlings; in the second, 5-year old trees; in the third, 10-year old trees, and so on in periods of 5 years up to 50 years. No tapping is done in the first four sections; in the sixth, seventh and eighth sections the trees are thinned by bleeding some of them to death, and in the thirteenth, fourteenth and fifteenth sections the trees are bled to their maximum extent without seriously injuring them. In the other sections some trees are bled to death, and others are bled with great care, the objects in view being the thinning of the trees when necessary, and the preservation of healthy permanent trees which are capable of yielding a large and regular supply of crude resin until the final crop is collected when the trees are 70 years old and the ground is cleared for young plants.

* See Elwes and Henry, l.c. p. 1115.

† See "Diplomatic and Consular Report," Annual Series, No. 5080 (France), pp. 17–20, May, 1913.

"February is employed in selecting the trees for tapping, the minimum girth of permanent trees chosen for the purpose being about 1·10 metres at an average height of a man's shoulder from the ground. The first incision is generally made in the side facing east and at the foot of the tree. The first year the tree is cut to a height of about 60 centim., with a width of 0·9 metres and a depth of 0·01 metres. A piece of zinc is placed at the foot of the cut to guide the resin into a pot which is tied at the foot of the tree. The second and following years the cut is made about 65 centim. high, but diminished in width to 0·8 metres for the second year and 0·7 for the third year, 0·6 metres for the fourth and fifth years. By the end of the fourth year the cut is about 8 feet high. The tree is then allowed to rest for three years, when another incision is made on the north-west side and the same procedure followed as described above. When the trees are to be bled to death, three or four cuts are made simultaneously on the trunk. Each cut is said to produce 3·3 lbs. of resin per year. (The process of bleeding the trees and collecting the resin is well illustrated by specimens in Museum No. III. at Kew.)

"Six crops are gathered each year in the months of April, May, June, July, September, October and November. The last crop is the most abundant, but its product is of inferior quality, the gum only yielding 15–16 per cent. of turpentine as compared to 21–24 per cent. obtained from the first crop. It is calculated that in the Landes about 231,000,000 lbs. of resinous products are obtained yearly, furnishing, after distillation, some 132,000 fifty-gallon barrels of turpentine weighing 7 lbs. to the gallon, and 185,000,000 lbs. of dry product, *i.e.*, 340,000 barrels of 480 lbs. of resin, the balance being composed of inferior stuff, waste, &c. In 1912 about £1 7s. 6d. a cwt. was obtained for turpentine, and about 15s. a cwt. for the best grades of resin. France exports about 63,000 fifty-gallon casks of turpentine and 197,000 barrels of 480 lbs. each of resinous products, Bordeaux and Bayonne being the principal ports of export. In 1912 the United Kingdom took 1147 tons of turpentine and 17,636 tons of resinous products."

In addition there is a big lumber industry. Small trees, after being bled to death, are used as pit props and 363,130 tons at prices ranging from 12s. 8d. to 18s. 3d. per ton were imported into the United Kingdom, chiefly to Bristol Channel ports, in 1912. The average free-on-board price at Bordeaux in 1912 was 16s. a ton, and the average freight from that port was 7s. a ton. In the *Timber News* for March 20th, 1915, Messrs. Osbeck and Co., Ltd., pitwood merchants, Cardiff, say that the normal import of mining timber into the Cardiff district amounts to 1,750,000 tons per annum, and that the war price has been below 20s. a ton ex-ship there. Some of this amount is from Scandinavia, the rest is from France. By an interchange of coal and pit props colliers are able to carry a full load each way which tends to lessen freight rates. Timber of this pine is also used for railway sleepers, paving blocks, and telegraph poles. The price of sleepers is about 2s. 8d. each. Clean timber is also cut up into

boards and other building material, whilst a market is found for the tops, all waste wood being of value for fuel.

The pit prop, turpentine and resin trade accounts for about 51 per cent. of the total export trade of Bordeaux.

P. Pinaster has been planted with success in South Africa, and it is suitable for planting on dunes and other sandy areas in countries where severe frosts are not experienced. It should be planted permanently whilst quite small, 9 inches to 1½ feet high, for, as is the case with most other pines, there is often considerable loss when larger trees are transplanted.

P. Pinea, *Linn.*—Stone, "Timbers of Commerce," pp. 277–278, enumerates the following common names for this pine:—Stone Pine, Italian Stone Pine, Umbrella Pine, White Pine, Black Pine, Mountain Pine, Double Spruce, Pin Pignon, Pin Bon, Pin de Pierre, Pin France, Pin Pinier, Pinie. It is also known as Pin Cultivé.

The species is widely distributed in the Mediterranean region, especially from Spain to Italy. Under favourable conditions it may grow 100 feet high with a girth of from 15 to 20 feet. In the open it is often found with a short, thick trunk and a wide-spreading, rounded head. Its dark green leaves are in pairs 4–5 inches long enclosed by a sheath at the base about ½ inch in length. The cones are solitary, erect, 4–6 inches long and 3–4 inches wide. They are very hard and woody and take three years to mature. They then remain on the branches for several years before the scales open. When collected they are opened by the application of heat. The scales of very old cones have been known to rot whilst the cones were still on the branches and the seeds have commenced to germinate amongst the decaying scales. The leaves bear a resemblance to those of *P. Pinaster,* but the cones are quite distinct. In Italy the tree is grown for the sake of its seeds, which are eaten both raw and roasted. Its timber is used locally for general carpentry work and bears a resemblance to that of *P. Pinaster,* the quality of the two being rather similar.

In this country it grows from 40–60 feet high and forms a handsome decorative tree, but it has no value for commercial planting. In South Africa it is planted under silvicultural conditions, with, it is reported, fairly satisfactory results.

P. sylvestris, *Linn.*—Scots Pine, Scotch Pine, Scotch Fir, Wild Pine, Pin Sylvestre, Sapin rouge du Nord, Bois rouge du Nord, Pin de Hagenan, Pin a'Mature, Pin Sauvage, Pin d'Ecorse, Pin de Geneve, Pin d'Auvergne, Pin Blanc d'Autriche, Gemeine Kiefer Fohre, Forle, Forche, Kichne, Weiss-Kiefer, Redwood, Baltic Redwood, Red Deal, Yellow Deal, Riga Fir, Memel Fir, Archangel Fir, Petchora Fir, Danzig Fir, Stettin Fir, Norway Fir, Polish Fir, Whitewood.

Pinus sylvestris or its wood may be met with under any one of the above-mentioned names, whilst new names are constantly appearing, each new port of shipment supplying one or more new names, usually as a prefix to fir or deal. Curiously, the wood is rarely referred to as pine wood by wood workers.

This species is widely distributed through northern and central Europe and north-western Asia, and is the most important coniferous timber of Europe. It is used for all kinds of building purposes, also for railway sleepers, telegraph poles, masts, scaffold poles, fencing, pit timber, paving, the extraction of turpentine and resin, etc. The timber varies a good deal in quality according to the district in which it has been grown. That from N. Russia and Scandinavia is usually regarded as the best, but prejudice may sometimes be the deciding factor, for plenty of good timber is produced in Central Europe, whilst the best of the timber from the old natural forests of Scotland is of excellent quality and probably equal in every respect to that imported from Russia. The best quality of imported timber is usually termed redwood, although the colour hardly warrants the name. It may be yellow in colour or yellow with a reddish tinge, and should be heart-wood of clean grown, well matured trees. Like other vernacular names, however, this one cannot be regarded as a guarantee of timber of one quality, for timber sold as redwood often varies a good deal in character. The wood also varies greatly in weight. As a rule it is between 23 lbs. and 38 lbs. per cubic foot, but some examples have been recorded which weighed scarcely 20 lbs. to the cubic foot, and others have exceeded 50 lbs.

When used for indoor work the best qualities of home-grown and imported wood last for an indefinite period. In some of the old Scottish castles and mansions roof timbers prepared from adjacent forests several centuries ago are still perfectly sound. Out of doors, wood treated with a preservative lasts well, but untreated wood soon decays, especially when in contact with the earth or in places where a free circulation of air is not maintained. Most of the timber used for posts, sleepers and paving blocks is treated with creosote, and as a rule an injection of from 7–9 lbs. to a cubic foot is considered sufficient for all practical purposes. In important thoroughfares, such as "The Strand," the life of creosoted redwood blocks is said to be about 7 years; in other places where traffic is moderately heavy the blocks may be calculated to last for from 12 to 15 years. One instance of the longevity of creosoted deal blocks, when subjected to exceedingly heavy wear, is Westminster Bridge, where blocks were in continuous use for 13 years. The life and utility of the blocks, however, does not depend entirely upon the quality of the wood and the amount of creosote it contains, but is partly determined by the quality of the bed upon which the blocks are laid and the filling and surfacing material that is used. An uneven bed or inferior concrete results in the blocks being pressed into the concrete, thus creating an uneven surface and exposing their edges to damp. Unequal filling of the crevices also allows moisture to lodge between the blocks. Railway sleepers and telegraph poles are also creosoted before use, and it is probable that it would pay to creosote scaffold poles, especially parts which are inserted in the ground. A great deal of fencing and material for the erection of farm buildings is also creosoted. Timber placed in a confined atmosphere is subject to dry rot, and even

when the space beneath floors is well ventilated, it is wise to creosote those portions that are built into walls. An idea of the importance of the wood of the Scots Pine in the timber market may be gathered from the figures given for the exports from Riga alone to the United Kingdom in 1912. Under the heading "Boards and Deals," the Board of Trade returns give—"pieces, 1,556,006; boards, 354,999 standards, value £2,464,670," whilst the timber export trade of Russia for 1912 was given as 6,861,887 tons, valued at £16,136,613.*

As already stated, very good pine wood is grown in Scotland, yet the prices obtained by the owners are often unsatisfactory, whilst that wood which is far removed from a manufacturing centre is heavily handicapped by transit charges. In fact, although about 4,500,000 tons of pit wood are required in the British Isles each year, British grown wood which is at a considerable distance from the nearest collieries, after cost of cutting and delivery have been deducted from the returns shows scarcely any margin for rent of ground and profit, so cheaply can foreign grown wood be supplied. Nevertheless, the Scots Pine is the most important pine for sylvicultural purposes in the British Isles at the present time and with improved methods of cultivation and marketing, prices will doubtless have an upward tendency.

Pinus sylvestris forms a tree up to 140 or 150 feet in height with a trunk diameter of from 1–3½ feet. The grey or glaucous-green leaves are 2–3 inches long, produced in pairs, rather broad in comparison to the length, and usually flat and slightly twisted. The cones are small, greyish, 1½–2 inches long, and nearly an inch wide. It grows well in light, dry, sandy soil and withstands considerable exposure. In one or two places in Scotland it is found at an altitude of nearly 2000 feet as a fair-sized tree, but as a rule the limit of its usefulness as a timber tree is reached between 1000 and 1500 feet.

On the Continent resin and other resinous products are obtained from the wood, but in Great Britain the Scots Pine is grown simply for its timber.

In Museum No. IV. at Kew an exhibit is made of timber grown in some of the principal forests of Scotland, and workers in pine wood would do well to compare the quality of the timber with that imported from foreign countries.

* See "Diplomatic and Consular Report," Annual Series, No. 5197 (Russia), p. 8, September, 1913.

XXIV.—WALTER HOOD FITCH, BOTANICAL ARTIST, 1817-1892.

W. Botting Hemsley.

Appreciative obituary notices of this talented artist are numerous,* and the high quality of the productions of his facile pencil is universally recognised in the botanical world; but few persons have any idea of the quantity and variety of his work, as no systematic and comprehensive record exists. An attempt at such follows below, and if it is not absolutely complete it is believed that no important contribution of his to the illustration of the vegetable kingdom has been omitted. That minor works exist to which we have no clue is possible, or even probable, because many of these appeared anonymously. Fitch was both artist and lithographer, so that his plates express his own conceptions and meanings. Much of his early work for Sir William Hooker's publications is unsigned. On this point Fitch himself informed the writer that Sir William invariably signed his own drawings, that the signatures of correspondents were always appended to their contributions, and that he himself was responsible for all the unsigned plates in the Botanical Magazine, Icones Plantarum, Kew Journal of Botany, etc., from 1834 onward. Sir William Hooker was himself an accomplished botanical artist, but his style is quite different from the bolder Fitchian style, his drawings being characterised by their more delicate and detailed finish. Biographically it will be sufficient to mention that our artist possessed a natural taste for drawing in early years, which soon developed into executive ability, and brought him employment in the factory of a Glasgow firm of calico printers, where Sir William Hooker discovered him and ransomed his indentures of apprenticeship. Under so able an instructor as Sir William, Fitch soon became proficient and even his early work revealed the artistic power of a genius. His career as a botanical artist commenced in October, 1834, with plate 3353 (*Mimulus roseus*), of the Botanical Magazine. It would be superfluous to enter into particulars of his progress to maturity, and his merits as an artist; his pencil always reveals the master hand. Nevertheless a few words of appreciation from the pen of his early patron are appropriately reproduced here. In his preface to Bauer's illustrations of the "Genera Filicum" Sir William Hooker says: "They have all been executed under my own eye in zincography by a young artist, W. Fitch, with a delicacy and accuracy which I trust will not discredit the figures from which they were taken." This was in 1842. Sixty years later, Sir Joseph Hooker, in the sketch of his father's life, refers to Fitch in terms of unstinted praise as one "who by his artistic talents contributed so largely to the value of my father's work." Fitch accompanied Sir William Hooker to Kew on his taking up

* See The Gardeners' Chronicle, Jan. 23, 1892; Journal of Botany, 1892, with portrait.

the Directorship, and during his long active career, practically every illustrated publication, official or unofficial, issued from Kew was adorned by his pencil. He was also a prolific contributor to the leading horticultural publications, but on this point the list which follows is eloquent. It is also evidence that Fitch must have been a rapid delineator. The production of the admirable and elegant little wood-cut illustrations of Bentham's "Handbook of the British Flora," and the "Lilies" of Elwes's monograph, afford excellent examples of his methods of drawing. In a standing position, with a block in one hand and a pencil in the other, he drew without hesitation, and with a rapidity and dexterity that was simply marvellous. The lilies he drew also in a standing position direct on the stone, which was posed at a slight angle. The bold freehand lines were laid on with an unerring sweep of the pencil. This was in 1880, when he was no longer in his prime. Fitch ceased illustrating the Botanical Magazine and other semi-official Kew publications in 1877. He continued producing, however, so far as his health permitted, up till about 1888. Prominent among his latest productions are the 110 beautiful plates illustrating the Botany of Salvin and Godman's "Biologia Centrali-Americana," 1879-1888. These plates, like so many of his, were prepared from dried specimens, and as a revivifier of herbarium specimens Fitch has never been surpassed, and perhaps never equalled. He was also as ready in adapting inferior drawings; witness the magnificent "Illustrations of Himalayan Plants." From time to time Fitch executed sets of excellent diagrams for lecturing purposes, though details of what he accomplished in this direction are wanting.

The Kew collection of drawings and published figures of plants includes a very large number of Fitch's original drawings, both published and unpublished. Among the latter, many intended for the "Botanical Magazine," and the prematurely discontinued "Refugium Botanicum." The British Museum also possesses, Dr. Rendle kindly reports, some of Fitch's original drawings, including studies for the plates of the *Victoria regia*.

Fitch received few distinctions; as there is no corporation that recognises the merits of botanical artists. Sir Joseph Hooker gave the name *Fitchia* to a very striking Pacific Islands genus of arboreus *Compositae* in 1845, and he dedicated the ninety-fifth volume of the Botanical Magazine to the "accomplished artist and lithographer of 2500 plates" of that publication, in 1869. From 1880 Fitch was the recipient of a Civil List pension of £100 a year, in recognition of his services to botanical science.

A rough approximate of the total of the published drawings, as tabulated below, is 9600, and doubtless reached 10,000, counting plates illustrating more than one species and diagrams and large folding plates containing many figures. Upwards of 5300 of these are coloured, ranging from the octavos of the "Botanical Magazine," the quartos of the Botany of Ross's Antarctic Voyage, and the folios of the Himalayan flora, to the elephant folio of the *Victoria regia*.

The compiler of the ensuing bibliography has received much assistance from the family of the deceased artist, and his thanks

are specially due to Miss Fitch, who extracted the statistics to a large extent, and followed up the clues afforded by the scanty existing correspondence.

Separate Publications.

General.

The Botany of Captain Beechey's Voyage (W. J. Hooker and G. A. Walker Arnott). 1830–1841. Ninety-nine plates; 38 signed by W. J. Hooker; 61 by W. H. Fitch, unsigned.

The British Flora (W. J. Hooker). Many illustrated editions, coloured and uncoloured. Fourth edition, 1838. Four plates. Fifth edition, 1842. Twelve plates.

The British Flora (W. J. Hooker and G. A. Walker Arnott). Successive editions of Hooker's Flora, mostly the same illustrations repeated. Altogether eight editions.

Letter to Dawson Turner on the death of the Duke of Bedford (W. J. Hooker). 1840. Coloured plate of *Bedfordia salicina*.

The Botany of the Voyage of H.M.S. "Herald" (B. Seemann). 1841–1855. One hundred plates; ten from drawings by J. D. Hooker; the rest by Fitch.

The Botany of Ross's Antarctic Voyage—Flora Antarctica; Flora Novae Zelandiae; Flora Tasmaniae (J. D. Hooker). Six quarto volumes. 1844–1860. Five hundred and twenty-eight plates, mostly drawn (or finished), and all lithographed by W. H. Fitch. There are coloured and uncoloured editions of the whole work.

Guide to the Royal Botanic Gardens, Kew (W. J. Hooker). 1847–1862. Twenty-one editions, averaging about 60 figures in text.

Niger Flora (W. J. Hooker). 1849. About fifty uncoloured plates; nearly all by W. H. Fitch.

Sikkim Rhododendrons (W. J. Hooker). 1849–1851. Thirty coloured plates, developed by W. H. Fitch from J. D. Hooker's original sketches.

Forest Trees (Mary Roberts). 1850. Twenty coloured plates.

Victoria Regia (W. H. Fitch). 1851. The descriptions by W. J. Hooker. Four coloured plates.

Palm Trees of the Amazon (A. R. Wallace). 1853. Forty-eight uncoloured plates lithographed by W. H. Fitch.

Popular Economic Botany (T. C. Archer). 1853. Twenty coloured plates, containing 102 figures. An abridgment of the same followed in 1854.

Himalayan Plants (J. D. Hooker). 1855. Pictorial title-page and thirty coloured plates. Re-drawn from native originals by W. H. Fitch.

Popular Garden Botany (Agnes Catlow). 1855. Twenty coloured plates.

A History of the Vegetable Kingdom (W. Rhind). 1857. Eighteen coloured plates and two engravings from W. H. Fitch's drawings.

Nueva Quinologia of Pavon (J. E. Howard). 1862. Twenty-seven coloured plates.

Field Botanist's Companion (T. Moore). 1862. Twenty-four coloured plates.

The Cedars of Lebanon (J. D. Hooker). Natural History Review, vol. ii. 1862. Three uncoloured plates.

Handbook of the British Flora, illustrated (G. Bentham). 1863. Twelve hundred and ninety-five figures in text.

Handbook of the Dublin Botanic Garden (D. Moore). 1865. Thirty-four woodcuts.

Flora Vitiensis (B. Seemann). 1865–1873. Ninety-seven coloured plates.

Illustrated London Almanac. 1866. Twelve wood engravings; flowers of the months.

Disease in Orchids, etc. (M. J. Berkeley). Journal of the Horticultural Society. 1866. Four uncoloured plates.

The Treasury of Botany (J. Lindley and T. Moore). 1862. Two hundred and sixty woodcuts in text.

Imperial Bible Dictionary (P. Fairbairn). 1866, 1888. Fifty-five and sixty woodcuts in text.

British Grasses (Margaret Plues). 1867. Sixteen coloured plates and 100 figures in text.

Quinology of East Indian Plantations (J. E. Howard). 1869–1876. Thirteen coloured and two uncoloured plates.

Domestic Botany (J. Smith). 1871 and 1883. Sixteen uncoloured plates and 14 woodcuts in text.

Guide to the Royal Botanic Gardens, Kew (D. Oliver). 1872–1885. Ten editions, averaging 54 figures in text.

Lahore to Yarkand (G. Henderson and A. O. Hume). 1873. Six coloured plates.

Illustrations of the Forest Flora of North-West and Central India (D. Brandis). 1874. Seventy uncoloured plates.

Bible Plants (J. Smith). 1877. Ten uncoloured plates.

Le Dessin Appliqué à la Botanique (W. H. Fitch). 1877. About 20 figures. Translation by Professor Edouard Morren from the Gardeners' Chronicle of 1869.

Biologia Centrali-Americana: Botany (W. Botting Hemsley). Five volumes. 1879 1888. One hundred and ten plates; a few coloured, constructed from Mrs. Salvin's paintings.

Peruvian Bark (C. Markham). 1880. Two figures from Howard's Quinologia of Pavon.

The Genus Lilium (H. J. Elwes). 1880. Forty-eight coloured plates.

Matabele Land and the Victoria Falls (F. Oates). 1881. Two coloured plates.

Botany of the Challenger Expedition (W. Botting Hemsley). 1885. Sixty-five uncoloured plates, eight of which by W. H. Fitch.

Botany of Socotra (I. B. Balfour). 1888. One hundred uncoloured plates; fifteen by W. H. F.

Flora and Fauna of Sinai, etc., Palestine Exploration (H. C. Hart). 1891. Nine uncoloured plates.

Two Poisonous Plants: Journal of the Agricultural Society (W. Carruthers). 1898. Two woodcuts reproduced from Bentham's Handbook of the British Flora.

Illustrated Bible Treasury (W. Wright). 1899. Fifty-three woodcuts in text, from Fairbairn's Dictionary of the Bible.

Orchids.

A Century of Orchidaceous Plants (W. J. Hooker). 1849. One hundred coloured plates.

Select Orchidaceous Plants (R. Warner). 1862–1878. Eighty coloured plates.

A Second Century of Orchidaceous Plants (J. Bateman). 1867. One hundred coloured plates.

Odontoglossum (J. Bateman). 1874. Thirty coloured plates.

Ferns.

Genera Filicum (W. J. Hooker). 1842. One hundred and twenty coloured plates, zincographed by W. H. Fitch from Francis Bauer's drawings.

Species Filicum (W. J. Hooker). 1846–1864. Three hundred and four uncoloured plates.

A Century of Ferns (W. J. Hooker). 1854. One hundred coloured plates.

A Popular History of British Ferns (T. Moore). 1857. Twenty coloured plates.

Filices Exoticae (W. J. Hooker). 1857–1859. One hundred coloured plates.

The British Ferns (W. J. Hooker). 1861. Sixty-six coloured plates.

Garden Ferns (W. J. Hooker). 1862. Sixty-four coloured plates.

Index Filicum (T. Moore). 1857–1862. Thirty uncoloured plates.

British Ferns (B. Seemann). 1860. Forty-eight coloured figures in one large plate.

A Second Century of Ferns (W. J. Hooker). 1861. One hundred coloured plates.

Ferns British and Foreign (J. Smith). 1866. One uncoloured plate and 164 figures in text.

British Ferns (Margaret Plues). 1866. Sixteen coloured plates and 56 figures in text.

Synopsis Filicum (W. J. Hooker and J. G. Baker). 1868. Nine plates containing 98 figures. Coloured and uncoloured editions.

Historia Filicum (J. Smith). 1875. Thirty uncoloured plates.

Mosses, Seaweeds, Fungi, Lichens.

Popular History of Seaweeds (D. Landsborough). 1849. Twenty coloured plates.

Popular History of Lichens (W. L. Lindsay). 1856. Twenty-two coloured plates, lithographed from Lindsay's drawings.

Outlines of British Fungology (M. J. Berkeley). 1860. Twenty-four coloured plates.

Handbook of British Mosses (M. J. Berkeley). 1863. Twenty-four coloured plates.

British Seaweeds (S. O. Gray). 1867. Sixteen coloured plates.

Elementary Botany.

Botanical Illustrations (W. J. Hooker). 1837. Twenty-six uncoloured plates containing 392 figures.

Elementary Botany (D. Oliver). Several editions. 1864–1874. About 200 figures in text.

First Book of Indian Botany (D. Oliver). 1869. Two hundred and forty-two figures in text.

Botanical Diagrams (G. Henslow). 1898. Nine folio sheets, reduced from large diagrams executed for South Kensington about 1874.

Illustrations of Natural Orders (D. Oliver). 1874. One hundred and nine coloured plates.

Botany. Science Primers (J. D. Hooker). 1876. Sixty-eight figures in text.

Society's Publications.

Transactions of the Linnean Society.

Brachynema and Phoxanthus (G. Bentham). Vol. xxii. 1859. Three uncoloured plates.

Henriquezia (G. Bentham). Vol. xxii. 1859. Three uncoloured plates.

Camellia Thea (B. Seemann). Vol. xxii. 1859. Two uncoloured plates.

Balanophoreae (J. D. Hooker). Vol. xxii. 1859. Four coloured and 11 uncoloured plates from J. D. Hooker's drawings.

Pitchers of Nepenthes (J. D. Hooker). Vol. xxii. 1859. Five uncoloured plates.

New Plants of the Malayan Archipelago and Tropical Africa (J. D. Hooker). Vol. xxiii. 1862. Eight uncoloured plates.

Three Oaks of Palestine (J. D. Hooker). Vol. xxiii. 1862. One uncoloured plate from J. D. H.'s drawing.

African Anonaceae (G. Bentham). Vol. xxiii. 1862. Five uncoloured plates.

Fissicalyx and Prioria (G. Bentham). Vol. xxiii. 1862. Two uncoloured plates.

A New Anisophyllea (D. Oliver). Vol. xxiii. 1862. One uncoloured plate and four woodcuts.

Sycopsis (D. Oliver). Vol. xxiii. 1862. One uncoloured plate and four woodcuts.

Prolification in Flowers (M. T. Masters). Vol. xxiii. 1862. One uncoloured plate.

Cassia moschata (D. Hanbury). Vol. xxiv. 1864. One uncoloured plate.

Garcinia yielding Gamboge (D. Hanbury). Vol. xxiv. 1864. One uncoloured plate.

Parasitism of Mistletoe (J. Harley). Vol. xxiv. 1864. Three uncoloured plates from J. Harley's drawings.

British Fungi (J. Currey). Vol. xxiv. 1864. One coloured plate.

Welwitschia (J. D. Hooker). Vol. xxiv. 1864. Eleven plates, partly coloured, and partly from J. D. H.'s drawings.

Walleria (J. Kirk). Vol. xxiv. 1864. One uncoloured plate.

Palms of West Tropical Africa (G. Mann and H. Wendland). Vol. xxiv. 1864. Six uncoloured plates.

Aristolochia (J. D. Hooker). Vol. xxv. 1866. One uncoloured plate.

New British Fungi (M. J. Berkeley). Vol. xxv. 1866. One coloured plate.

Hillebrandia (D. Oliver). Vol. xxv. 1866. One uncoloured plate.

Circulation and Formation of Wood in Plants (H. Spencer). Vol. xxv. 1866. One uncoloured plate.

Plants of Anamallay Mountains (R. H. Beddome). Vol. xxv. 1866. Seven uncoloured plates.

Tropical Leguminosae (G. Bentham). Vol. xxv. 1866. Twelve uncoloured plates.

Myostoma (J. Miers). Vol. xxv. 1866. One uncoloured plate.

Lichens of New Zealand (W. L. Lindsay). Vol. xxv. 1866. Four coloured plates from Lindsay's drawings.

Lichens (D. A. Leighton). Vol. xxv. 1866. One coloured plate from Leighton's drawings.

Fungi Angolenses (F. Welwitsch and F. Currey). Vol. xxv. 1866. Four uncoloured plates.

Branched Palms (S. S. Andy). Vol. xxvi. 1870. One uncoloured plate and two woodcuts.

Begoniaceae (D. Oliver). Vol. xxvi. 1870. One uncoloured plate.

Bambusae (W. Munro). Vol. xxvi. 1870. Six uncoloured plates.

New Genera of Plants (D. Oliver). Vol. xxvi. 1870. Three plates from Oliver's drawings.

Lichens (W. L. Lindsay). Vol. xxvi. 1870. Eight partially coloured plates.

Boswellia (G. Birdwood). Vol. xxvii. 1871. Four uncoloured plates.

Cassia (G. Bentham). Vol. xxvii. 1871. Four uncoloured plates.

Lichens of West Greenland (W. L. Lindsay). Vol. xxvii. 1871. Five uncoloured plates from Lindsay's drawings.

Sertum Angolense (F. Welwitsch). Vol. xxvii. 1871. Twenty-six uncoloured plates.

Melastomaceae (J. Triana). Vol. xxviii. 1873. Seven uncoloured plates from Triana's drawings.

Plants of Speke and Grant's Expedition (D. Oliver). Vol. xxix. 1875. Eighteen uncoloured plates.

Orchids Collected by E. Parish (H. G. Reichenbach). Vol. xxx. 1875. Six uncoloured plates from Parish's drawings.

Ferns of British Sikkim (J. Scott). Vol. xxx. 1875. Eighteen uncoloured plates.

Mimosae (G. Bentham). Vol. xxx. 1875. Five uncoloured plates.

Central African Plants (C. de Ficalho and W. P. Hiern). Vol. ii. series 2, 1881–1887. Four uncoloured plates.

New Cycas (W. T. T. Dyer). Vol. ii. series 2 1881–1887. One uncoloured plate.

Plants of Kilima-Njaro (D. Oliver). Vol. ii. series 2, 1881–1889. Three uncoloured plates.

Transactions of the Botanical Society of Edinburgh.

Lepidodendron and Calamites (W. Carruthers). 1866. Two uncoloured plates.

Botany of Socotra (I. B. Balfour). 1888. Seventeen uncoloured plates.

Serials and Periodicals.

Botanical Magazine (W. J. and J. D. Hooker). 1834–1877. About 2900 coloured plates. Plates 6353–6357 and 6389 (1878) also bear Fitch's initials. The original drawings are in the Kew collection.

The Journal of Botany (W. J. Hooker). 1834–1840. Thirty-five uncoloured unsigned plates.

Companion to the Botanical Magazine (W. J. Hooker). 1835–1836. Twenty-six partially coloured plates.

Icones Plantarum (W. J. and J. D. Hooker, and others). 1837–1876. Four hundred and eighty-five uncoloured plates. All of the unsigned plates of this period are by W. H. Fitch.

The London Journal of Botany (W. J. Hooker). 1842–1848. One hundred and forty plates.

The Journal of Botany and Kew Garden Miscellany (W. J. Hooker). 1849–1857. Eighty uncoloured and 22 coloured plates and eight reproductions.

Bonplandia (B. Seemann). 1853–1862. Eleven coloured and two uncoloured plates.

Floral Magazine (T. Moore). i. 1861. Sixty-four coloured plates.

The Florist and Pomologist (R. Hogg and others). 1862–1884. Two hundred and twenty-three coloured plates.

The Journal of Botany (B. Seemann and others). 1863–1876. Thirty-nine coloured and twelve uncoloured plates.

The Gardeners' Chronicle, 1869–1883.

W. H. Fitch's contributions to the *Gardeners' Chronicle* are of a varied character, and difficult to estimate in relation to number. Apparently the first (1869) was a series of Lessons on Botanical Drawing, illustrated by about a score of figures. Then followed, scattered through a number of volumes, a series of some thirty-two full-page illustrations, uncoloured. There is also a collection of handsome supplemental folio coloured plates, representing groups of Orchids, Camellias, Gladioluses, Tulips, Lilies, Calceolarias, Roses, Plums, etc., and pictorial coloured Almanacs for the years 1879 to 1883, or thereabout—altogether perhaps about twenty-five.

Journal of Horticulture and Cottage Gardener. Maiden-hair Fern, 1879. One figure in text.

XXV.—THE GENUS PHELIPAEA.

O. Stapf.

(With Plate.)

The revision of this genus, which includes some of the most brilliantly coloured phanerogamic parasites of the Oriental flora, was suggested by the flowering of one of its members *P. foliata*, Lamb., in the rock garden at Kew in the summer of last year. It has demonstrated the existence of at least three distinct species, diagnoses of which are given below. At the same time the history of the genus itself with its varying definitions and name changes is remarkable enough to be put on record more fully than by the mere references usually given under the headings "literature" and "synonymy." Thanks to the courtesy of M. Gustave Beauverd, it has also been possible to account for those specimens which were mentioned by Boissier in his Flora Orientalis, but are not represented at Kew, and thus practically to complete the enumeration of all the more important stations where *Phelipaea* has been found.

History of the genus.—The genus *Phelipaea* or *Phelypaea*—the author himself spelt it both ways—was published by Tournefort in his "Corollarium Institutionum Rei Herbariae (p. 47) in 1703. It comprised two species, viz., "*Phelipaea orientalis, flore coccineo*" and "*Phelipaea lusitanica, flore luteo*"; but the description was drawn up and illustrated (tab. 479) from the former only, so that "*Phelipaea orientalis flore coccineo*" must be taken as the basis of Tournefort's genus. The author does not indicate the country whence this *Phelipaea* came, but Desfontaines, in Choix de Plantes du Corollaire de Tournefort (1808) p. 18, states that it is a native of Armenia, and the excellent figure published in the same volume from a drawing by Aubriet, the artist who accompanied Tournefort on his journey to the Levant, leaves no doubt that it is the species which has since repeatedly been collected in the neighbourhood of Erzerum, where Tournefort stayed and collected from June 15 to July 6, 1701, just the time when the plant would have been in flower. The paragraph containing the dedication of the genus runs "Phelypaea ab Illustrissima Phelypaeorum Gente, ex qua tot prodiere Regni administri, quos inter maxime conspiciendi summus ille Galliarum Cancellarius Ludovicus Phelypeaux et Hieronymus Phelipeaux Rei Navalis Praefectus, huius aevi Mycecenates, etc." The Phelipeaux—or, more correctly, Phelypeaux*—were an old French family which for generations was prominently connected with the legal profession, and gave France more than one eminent administrator. One of them, Louis Phelypeaux, Count de Pontchartrain (1643-1727), was in Tournefort's time Controlor General and Minister of Marine, and since 1699 Secretary of State. He had charge of the Academies, and in this capacity moved his sovereign, Louis XIV., to "send abroad into foreign Countries some Persons that were capable of making

* See Rouy in Bull. Soc. Bot. France, vol. lvi. (1909) p. 50.

pertinent Observations, not only upon the natural History and the old and new Geography of those Parts, but likewise in relation to the Commerce, Religion and Manners of the different People inhabiting there."* Tournefort was appointed leader of the expedition, and the details were arranged between him and Louis Phelypeaux. Thus it was that the 22 letters in which the account of the expedition is given were all addressed to Monseigneur the Count de Pontchartrain, and Tournefort was more than justified in dedicating to him one of his most handsome discoveries. Jerome Phelypeaux, whose name is coupled with that of Louis, was the latter's son, and, from 1699, his successor as Minister of Marine. No mention is made of *Phelipaea* in the account of the journey, but this is easily understood when we consider that the letters were written on the journey and not published until 1717—that is, 9 years after the death of the author. The other species referred by Tournefort to *Phelipaea*, viz., "*P. lusitanica, flore luteo*," was recorded by Grisley in his "*Viridarium Lusitanicum*" as early as 1661 under the name "*Orobanche elegantissima verna, flore luteo.*" A drawing and a carbon impression of it marked "D. Tourn. e Portugalia D. Sherard" is in Morison's Herbarium, and a description was published by Bobart in Morison's Plantarum Historia, vol. iii. (1699) p. 502. Whether Tournefort had it from Grisley or collected it himself when in Portugal in 1688, as is most likely, is uncertain. In any case there is no reference to it in his "Institutiones Rei Herbariae" (1700), and its inclusion in *Phelipaea* may have been merely an afterthought or an error due to the haste with which the Corollarium was prepared, there being only five months between Tournefort's return from the Orient and the passing of his paper by the Academy on December 9, 1702. However that may be, the mistake became subsequently the source of much confusion.

The first to continue and even aggravate the error was Linnaeus who in his Species Plantarum (1753) p. 606, reduced Tournefort's two species to varieties of one species, which he transferred to *Lathraea* as *L. Phelypaea*, the Portuguese plant standing as the "type" and the oriental as var. β. When towards the end of the 18th century the Russians discovered what we now know to be a congener of Tournefort's *P. orientalis, flore coccineo* they first put it down as *Lathraea Phelypaea* [Güldenstaedt, Reisen d. Russland i. (1737) p. 422 and Pallas Herb.; Georgi, Beschreib. d. Länd. d. Russ. Reich. iii. (1800) p. 1102] but subsequently transferred it to *Orobanche* as *O. coccinea*, assuming that it was identical with Tournefort's Oriental *Phelipaea* [Marschall v. Bieberstein, Tabl. Crim. (1797) p. 8, and Fl. Tauro-Caucas. ii. (1808) p. 84; iii. (1819) p. 418, and Cent. Pl. Rar. Ross. ii. (1832) t. 56] or as *O. Phelipaea* [Marsch. v. Bieb. Beschreib. d. Länd. am Casp. Meer. (1800) App. 179]. Willdenow in Spec. Pl. iii. (1800) p. 354, accepted Marschall's name *O. coccinea* for the Oriental plant, although he had some doubt as to identity of his and Tournefort's species. Meanwhile Desfontaines, in Flora

* Tournefort, Voyage into the Levant (Engl. Transl., 1741) 1, i.

Atlantica ii. (1800) p. 60, had re-established the Tournefortian genus, giving a diagnosis of it and of *P. lutea* (*Phelipaea lusitanica, flore luteo,* Tourn.) and a description of a new species *P. violacea* as well as excellent figures of both of them. No reference was made to the Oriental plant and the generic description was evidently drawn up from the two species mentioned, with which he was, of course, particularly familiar; but in his Choix de Plantes du Corollaire de Tournefort, published originally in the Annales du Museum d'Histoire Naturelle, vol. x. (1807) and separately in 1808, he added it under the name of *P. Tournefortii* with a very full description accompanied by Aubriet's figure and also pointed out certain differences between *Phelipaea* as understood by him and *Lathraea* and *Orobanche.* Poiret, in Encyclopédie Méthodique, vol. v. (1804) pp. 267, 268, had by that time come to a similar conclusion, except that according to him *P. coccinea* (*Orobanche coccinea,* of Marschall and Willdenow) stands as the third species, as he was uncertain about Tournefort's *Phelipaea orientalis, flore coccineo* which he placed curiously enough as a possible synonym under *Phelipaea lutea.* In 1784 Thunberg in Nova Genera Plantarum p. 91, quite independently of Tournefort had established a genus *Phelypaea* on a South African plant, also a parasite but of very different affinity. With Thunberg's and Desfontaines' definitions of *Phelipaea* before him A. L. de Jussieu submitted the two genera to a critical examination the results of which he embodied in a "Mémoire sur le genre Phelipaea de M. Thunberg et sur d'autres plantes qui portent le même nom" in Annales du Museum d'Histoire Naturelle, vol. xii. (1808) pp. 439–447. Having proved the generic identity of Thunberg's *Phelypaea* with Linnaeus' *Cytinus* he proceeds to analyse Desfontaines' genus of the same name with great acuteness and clearness. He, too, points out that Desfontaines drew his characters of the genus in the first place from the two Atlantic species which might or might not be referred to *Orobanche,* whilst his third species, *i.e. Phelipaea Tournefortii* approaches *Aeginctia** and he concludes by saying "il est possible de laisser les deux genres séparés, de conserver *l'aeginctia* de M. Roxburg, et de réserver le nom *phelipaea,* plus ancien, pour la plante de Tournefort et celle de M. Willdenow, formant ou deux espèces ou une seule. De toutes manières, ce nom retranché a la plante de M. Thunberg, peut sans difficulté être restituée a une des plantes de Tournefort, qui le possédoient primitivement." It was therefore Jussieu who for the first time clearly recognised the heterogeneity of Tournefort's genus and reduced it to the original Oriental element on which Tournefort had based his description and illustration of the genus.

Unfortunately no notice was taken of Jussieu's memoir and when Wallroth in 1825 published his "Orobanches Generis

* This was already suggested by Adanson (Famille d. Pl. ii. (1763) 207) who sunk *Aeginetia* in *Phelipaea* and by Lamarck (Encycl. Meth. ii. (1786) 28).

Διασκευη" we find Tournefort's Oriental *Phelipaea* in *Orobanche*, just as in Willdenow's Species Plantarum, but now forming together with the American *Orobanche uniflora* (*Aphyllon uniflorum* of most authors) a distinct "tribus" *Anoplon*, whilst the Portuguese species is described as *Orobanche Phelypaea*, Wallr., and with *Orobanche violacea*, *Orobanche Phelypaea*, *Willd.* and *O. tinctoria*, Forsk. referred to a new "tribus" *Haemodoron*. The very unnatural "tribus" *Anoplon* was raised to generic rank by Reichenbach (Consp. Regn. Veg. 212 b 1828), following which C. A. Meyer in 1831 formed the combination *Anoplon Biebersteinii* (Verzeichn. d. Pflanz. Caucasus, p. 104) with an emended generic diagnosis, evidently adapted to the Caucasian species. Endlicher in Genera Plantarum (1839) p. 727 adopted Reichenbach's view, but finding *Anoplon* already in use in zoology, he changed it into *Anoplanthus*, creating a section *Anblatum* for the reception of the Oriental plant. This barbarous name, a corruption of the German Ohnblatt, he took over from Tournefort (Corr. Inst. p. 48) who, however, had applied it to a totally different plant, possibly a species of *Lathraea*. Walpers then made the combination *Anoplanthus coccineus* in 1844 (Repert vol. iii. p. 481). Reuter in De Candolle's Prodromus vol. xi. (1847) pp. 41–43 followed Endlicher, except in so far as he replaced the name *Anblatum* by *Macranoplon*. The same nomenclature was adopted by Boissier in Flora Orientalis, vol. iv. (1879) p. 494, although Bentham in Bentham and Hooker, Gen. Plant. ii. p. 982, some three years previously had revived Tournefort's genus in the circumscription given to it by Jussieu. Beck in his monograph of *Orobanche* (Bibl. Bot. vol. iv. 1890 p. 58, and in Engler and Prantl's Natürliche Pflanzenfamilien iv. 3 B (1895) 129 also has *Phelipaea* in the same sense. When Wallroth transferred *Phelipaea coccinea* to *Orobanche* and *Anoplon* and separated from it Desfontaines' West-Mediterranean species, placing them in a "tribus" *Haemodoron*, he added that he preferred to drop the name *Phelipaea* as it had already been given to another genus by Thunberg and that *Haemodoron* Theophrastes had priority over it. This group contained *Orobanche violacea* (*Phelipaea violacea*, Desf.), *O. tinctoria and O. Phelypaea* (*Phelipaea lutea*, Desf.), the last two being the species for which Hoffmannegg and Link had established a distinct genus *Cistanche* as early as 1809 (Flore Portugaise, vol. i. p. 319). Subsequently (1830) C. A. Meyer in Ledebour's Flora Altaica, vol. ii. p. 459, connected *Haemodoron* as a section with Wallroth's "tribus" *Trionychon* into a genus for which he claimed the name *Phelipaea*. This arrangement was adopted by Endlicher in his General Plantarum p. 727 and by Reuter in his monograph of *Orobanchaceae* in De Candolle's Prodromus, vol. xi. p. 4, but with this difference that the sectional name *Haemodoron* gave way to *Cistanche*. Boissier too accepted *Phelipaea* in that sense, and it was not until 1890 that the combination *Haemodoron* (*Cistanche*) + *Trionychion* was broken up by G. Beck (in Biol. Bot., vol. iv. p. 56) the latter forming a section of *Orobanche*, the former a distinct genus *Cistanche*. The name

Phelipaea has thus been applied to plants of widely different appearance, such as the brilliant solitary-flowered Phelipaeas of the Orient, the stately Cistanches of the Atlantic flora and the more commonplace Orobanches allied to *O. aegyptiaca*.

The species of Phelipaea.—Tournefort's *P. orientalis, flore coccineo*, was undoubtedly collected in Armenia, most likely in the neighbourhood of Erzerum, and it has since repeatedly been collected near there and in Russian Armenia and Turkish Kurdistan. A second species was discovered by Güldenstedt in 1772 in Kachetia, probably near Tiflis, and subsequently (1796) by Marschall von Bieberstein on the north side of the Caucasus and in Daghestan. It was considered to be identical with Tournefort's plant, and Marschall's name *Orobanche coccinea* was intended to cover the Armenian and Caucasian plant. It is true that Willdenow (Sp. Plant. iii. (1800) p. 354) quoted Tournefort's synonym with a query under *Orobanche coccinea;* but he added "Saltem convenit figura floris Phelypaea in Institutionibus rei herbariae t. 479 exacte cum planta nostra." Poiret four years later (Encycl. Méth. vol. v. p. 268) mentions Tournefort's *Phelipaea orientalis, flore coccineo* (without reference to the figure on t. 479) as a possible synonym of *P. lutea*, but he also says "Je soupçonne que la plante A de Tournefort n'est qu'une variété de celle-ci (*P. lutea*) à fleurs d'un rouge pourpre. Il faudroit d'ailleurs, pour prononcer sur cette espèce, des détails qui nous manquent," and under *P. coccinea* "l'espèce de Tournefort, que nous avons rapportée à la plante précédente, mais avec doute, n'a pas moins de rapports avec celle-ci." Desfontaines, on the other hand, was more definite on this point. He remarks in Choix de plantes du Corollaire (p. 17), "Il est très-douteux que cette plante soit la même quel'*Orobanche coccinea* de M. Willdenow, dont la tige, d'après la description qu'il en a donnée, est garnie de feuilles écartées, et dont les découpures de la corolle ont une forme ovale. Le Phelipaea de Tournefort a les tiges nues et les divisions de la corolle sont circulaires et non ovales." Lambert, in 1810, having examined the Caucasian and Crimean specimens in Pallas' Herbarium, decided that the Armenian and the Russian plants represent two distinct species, for the latter of which he proposed the name *Phelipaea foliata*, and for the former *P. Tournefortii*. In a contribution to the Dictionnaire des Sciences Naturelles, vol. xxxix. (1826) p. 466, Poiret accepted Lambert's view, but claimed the name *coccinea* exclusively for the Caucasian plant in preference to *foliata*. Then in 1831, although aware of Lambert's name, C. A. Meyer (Verzeichn. Pflanz. Cauc. p. 104) introduced yet another name, namely, *Biebersteinii* (*Anoplon Biebersteinii*) which was preserved by Reuter in his monograph of the *Orobanchaceae* in De Candolle's Prodromus vol. xi. (1847) p. 42 (*Anoplanthus Biebersteinii*). Meanwhile Walpers in 1844 had once more united the Armenian and Caucasian plants into one species as *Anoplanthus coccineus*. This view was accepted by Boissier in Flora Orientalis, vol, iv. (1879) p. 494, but with this modification that he at the same time split off the Tournefortian plant as var. *peduncularis* and a form collected by

Haussknecht in Persian Kurdistan as var. *nigrovittatus;* but his conception of what might be called "typical" *Anoplanthus coccineus* and in the first place was intended to represent the Caucasian plant was vitiated by the inclusion of material from Western and Southern Asia Minor, which, as will be shown below, belongs to a third and hitherto undescribed species. Finally in 1904, Bornmüller in Bull. Herb. Boissier, 2nd sér. vol. iv. p. 687, went back to Marschall's (and Walper's) view of the identity of the Armenian and Caucasian plants, adopting Poiret's combination *Phelipaea coccinea*, and including under it the whole of the specimens quoted by Boissier.

Considering the confusion connected with the name *coccinea*, it seems to be best to drop it altogether and accept for the two old species the names proposed by Desfontaines and Lambert, that is *Phelipaea Tournefortii* and *P. foliata*. The third and new species, to which allusion has already been made, was described as var. *Boissieri* of *Anoplanthus Biebersteinii* by Reuter in DC. Prod. xi. (1847) p. 42, after its discoverer Boissier, and may now be known as *Phelipaea Boissieri*. To it belongs very probably a plant described by Boissier as *Anoplanthus coccineus* var. *nigrovittatus*. See below p. 293.

Definition and bibliography of the species.—The differential characters of the three species which make up the genus Phelipaea are set out in the following key, after which fuller descriptions and bibliographical notes follow:—

Calyx conspicuously 2-lipped, upper lip subentire; corolla lobes round, distinctly imbricate; anthers bearded; pubescence of elongated, gland-tipped hairs; scale leaves more or less congested at the base, distinctly sheathing ... ... 1. *Tournefortii*.

Calyx 5-fid, lobes subequal, the 3 posticous conniving into an upper, the 2 anticous into a lower lip; pubescence of very short gland-tipped hairs; scale leaves more or less scattered, semi-amplexicaul, very rarely the uppermost shortly sheathing.

Corolla lobes round, distinctly imbricate; anthers bearded ... ... 2. *Boissieri*.

Corolla lobes roundish oblong, spreading; anthers glabrous ... ... 3. *foliata*.

1. **P. Tournefortii,** *Desf.*—Caulis sparse vel superne densiuscule fulvo-vel cinereo-glanduloso-pubescens, pilis ad 0·75 mm. longis, quorum cellulis 2 inferioribus 2–4-plo longioribus quam latis. *Squamae* basi congestae, in speciminibus elatis alte vaginante, in nanis abbreviatae, parte libera breviter late ovata subacuta vel subcucullata. *Calyx* campanulatus bilabiatus, 1·5–2·5 cm. longus, tubo 7–10 mm. longo, labis supero latissimo subintegro, infero ad vel ultra medium bifido, lobis oblongis obtusis, totus pube eadem ac caulis interdum densa indutus. *Corollae* tubus latus, leviter curvatus, supra medium oblique ampliatus, 1·5–2·5 cm. longus, extus superne magis minusve glanduloso-pubescens; limbus coccineus, bilabiatus, lobis sub-

aequalibus nisi labii superioris paulo brevioribus, rotundatis obtusissimis vel late subemarginatis 1·2·5 cm. diametro, labio infero ad fauces maculo atro hirsuto in tubum descendente obcordato ornato. *Filamenta* ima basi albo-ciliata, caeterum glabra; antherae mucronatae, albo-barbatae, mucrone dempto 3–4 mm. longis. *Stigma* subbilobo, 3 mm. diametro.

Phelipaea orientalis, flore coccineo, Tournef. Coroll. Instit. R. Herb. (1703) 47; Lam. Encycl. Méth. ii. (1786) 28, in note on *Phelipaea*. *Lathraea Phelypaea*, β, Linn. Spec. Pl. ed. i. (1753) 606; ed. ii. (1763) 844.

Orobanche coccinea, Marsch.-Bieb., Tabl. Prov. entre Terek et Kour (1797) 58, and Fl. Taur. Cauc. ii. (1808) 84; Willd. Spec. Pl. iii. (1808) 354; Wallroth, Orob. Gen. Διασκευη (1825) 68. *O. Phelipaea*, Marsch.-Bieb., Beschreib. Land. Casp. Meere (1800) App. 179. *Phelipaea lutea*, Poir. Encycl. Méth. v. (1804) 268. *?P. coccinea*, Pers. Syst. ii. (1807) 181; all as to syn.

Phelipaea Tournefortii, Desf. in Ann. Mus. Hist. Nat. x. 298 (1807) t. 21, and Choix Pl. Coroll. Tourn. (1808) 16 t. x.; Poir. Encycl. Méth. Suppl. iv. (1816) 392, and in Dict. Sc. Nat. Hist. xxxix. (1826) 466. *Anoplon Tournefortii*, Don, Gen. Syst. iv. (1837) 633. *Anoplanthus coccineus*, Walp. Rep. iii. (1845) 481 (in part). *A. Tournefortii*, Fisch. in Bull. Soc. Nat. Mosc. xxv. (1852) 106; Boiss. et Buhse, Aufzähl. Transkauk. u. Pers. Pfl. (1860) 169; Tchichatcheff, As. Min. ii. (1860) 60. *A. coccineus* var. *pedunculatis*, Boiss., Fl. Or. iv. (1879) 494. *A. coccineus* var. *Tournefortii*, Lipsky in Act. Hort. Tifl. iv. (1899) 413. *Phelipaea coccinea*, Bornm. in Bull. Herb. Boiss. sér. 2, iv. (1904) 687, in part.

2. **P. Boissieri**, *Stapf*, sp. nov. Caulis pube eadem ac *P. foliatae*. *Squamae* oblongae, obtusae vel obtussimae, semi-amplexicaules vel raro breviter vaginantes, longitudine valde variae, secundum caulem ad ejus medium dispersae, superiores saepe remotae. *Calyx* campanulatus, subaequaliter 5-lobus, 1·75–3·5 cm. longus, tubo lato 7–10 mm. longo, ob lobos posticos 3 retrorsum et anticos 2 antrorsum approximatos subbilabiatus, lobis oblongis obtusiusculis anticis interdum minute apiculatis, totus magis minusve pube eadem ac caulis indutus. *Corollae* tubus latus, leviter curvatus, 1·7–2·8 cm. longus, supra medium sensim oblique ampliatus, extus tenuiter glanduloso-papillosus (saltem superne), intus antice ex faucibus usque ad staminum insertionem ferrugineo- vel atro-barbatus; limbus coccineus, 2-labiatus, lobis subaequalibus rotundis imbricatis, labii superi (in floribus majoribus) 1·5–2 cm., labii inferi patentis 2–2·5 cm. diametro, labio infero ad fauces maculis binis atris in tubum descendentibus et ibi confluentibus villoso-barbatis ornato. *Filamenta* inferne ciliata; antherae mucronatae, albo-barbatae, 3–4 mm. longae. *Stigma* subintegrum, 4–5 mm. latum.

Anoplanthus Biebersteinii, var. *Boissieri*, Reut. in DC. Prodr. xi. (1847) 42 (excl. Reichenbach's syn.). *A. coccineus*, Boiss. Fl. Or. iv. (1879) 494 (excl. the varieties and the specimens from the Crimea and the Caucasus). *Phelipaea coccinea*, Bornm. l.c. in part.

P. foliata, *Lamb.* (See plate facing p. 294.) Caulis sparse vel superne densiuscule pube minutissima glandulosa atro-rufa indutus, pilis ad 0·25 mm. longis quorum cellulis vix longioribus quam latis. *Squamae* ovato-oblongae, obtusae, semiamplexicaules, longitudine valde variae, secundum caulem ad eius medium dispersae, magis minusve remotae. *Calyx* late campanulatus, inaequaliter 5–lobus, 1·5–3 cm. longus, tubo cupulari 5 (raro ultra) mm. longo, ob lobos posticos 3 retrorsum, anticos 2 antrorsum approximatos subbilabiatus, lobis oblongis vel ovatis obtusis vel acutis, totus magis minusve pube eadem ac caulis indutus. *Corollae* tubus latus, curvatus, 1·5–2·5 cm. longus, supra medium obliquissime ampliatus, extra flavidus, rubro-suffusus et superne tenuiter papillosus, intus antice e faucibus ad staminum insertionem ferrugineo-barbatus; limbus coccineus, 2-labiatus, lobis subaequalibus rotundo-ellipticis vel rotundo-oblongis patentibus obtusis fere 1·5 cm. longis paulo minus latis, labio infero ad fauces maculis binis atris in tubum descendentibus et ibi confluentibus rufo-barbatis ornato. *Filamenta* glabra; antherae mucronatae, 3 mm. longae, glabrae. *Stigma* subintegrum, fere 3 mm. diametro.

Lathraea Phelypaea, Güldenst. Reis. d. Russl. i. (1787) 422; Georgi, l.c. iii. (1800) 1102 and Nachtr. (1802) 281, non Linn. *Orobanche coccinea,* Marsch.-Bieb., Tabl. Prov. entre Terek et Kour (1797) 58; Fl. Tauro-Cauc. ii. (1808) 84 (excl. Tournefort's and Lamarck's syn.); Cent. Pl. Rar. Ross. ii. (1832), t. 56; Willd. Spec. Plant. iii. (1800) 354 (excl. Tournefort's syn.); Wallroth, Orob. Gen. Διασκευη (1825) 68 (excl. Tournefort's and Linnaeus' syn.); Georgi, Beschreib. Russ. R. Nachtr. (1802) 283; Reichenb. Pl. Crit. vii. (1829) 49, t. 699; Steven, Verzeichn. Taur. Pflanz. (1857) 274. *O. Phelipaea,* Marsch.-Bieb., Beschreib. Länd. Casp. Meer. (1800) App. 179 and in Konig and Sims, Ann. Bot. ii. (1806) 447 (excl. syn.). *Phelipaea coccinea,* Poir. Encycl. Méth. v. (1804) 268; Suppl. iv. (1816) 391; Dict. Sc. *Hist. Nat.* xxxix. (1826) 466; Pers. Syn. ii. (1807) 181 (excl. Tournefort's syn.); Bornm. in Bull. Herb. Boiss. sér. 2. iv. (1904) 687, in part. *P. foliata,* Lamb. in Trans. Linn. Soc. x. (1811) 260, t. 7; Hohenack. in Bull. Soc. Nat. Mosc. vi. (1833) 242; O. Stapf. in Bot. Mag. t. 8615. *P. Biebersteinii,* Fisch. ms. ex Wallr. l.c. as syn.

Anoplon Biebersteinii, C. A. Mey., Verzeichn. Pfl. Cauc. (1831) 104; Don, Gen. Syst. iv. (1837) 633; C. Koch in Linnaea xvii. (1843) 290. *A. coccineum,* C. Koch in Linnaea xxii. (1849) 670. *Anoplanthus coccineus,* Walp. Rep. iii. (1844) 481, in part; Ledeb., Fl. Ross. iii. (1847–1849) 324 (excl. certain synonyms). Boiss. Fl. Or. iv. (1879) 494, in part; Arnoldi ex Fedtschenko in Bot. C. Blatt, lxxiii. (1898) 76; Akinfiew, Nördl. Kauk. in Denkschr. Kauk. Abt. Russ. Geogr. Ges. xvi. i. (1893) ex Just, Jahresber. (1894), ii. 211; Thomin, in Act. Hort. Tifl. vi. ii. (1902) 56; Gard. Chron. lv. (1914) 401, fig. 184. *A. Biebersteinii,* Reut. in DC Prod. xi. (1847) 42, excl. var. β; Fisch. in Bull. Soc. Nat. Mosc. xxv. (1852) 105, t. 1; Regel in Gartenfl. (1880) 34, tab. 1000.

A. coccineus, var. *nigrovittatus,* Boiss. [Fl. Or. iv. (1879) 494] belongs very probably to this species. It is known to me only from Boissier's description: "corolla vitta lata nigra obsita"; but M. Beauverd (in a letter) describes it thus: "C'est une plante aussi élevée que les plus grands échantillons Hohenacker; son calice à divisions aiguës mesure 30 mm. long., et sa corolle à tube rétreci à la gorge atteint 60 mm. de longeur; les étamines sont barbues et atteignent le sommet du stigmate qui a 6 mm. de diametre; le nectarostège est disposé en anneau à la hauteur du point d'insertion des filets staminaux et se compose de longs cils d'un pourpre foncé. Les feuilles, nulles à la base, sont éparses tout le long de la tige; à peine amplexicaules, elles mesurent 20+20 mm. dans la partie inférieure de la tige et 20+30 mm. vers le sommet; le haut du pedoncle et l'extérieur du calice offrent la même pubescence rousse et très brièvement glanduleuse du Phelipaea que Kotschy, dans son exsiccata No. 44 (imprimé) nommait β *Boissieri.* Cette variété '*nigrovittatus,*' si elle n'est une espèce autonome (?) se rattacherait plutôt à votre *P. Boissieri;* elle n'est representée ici que par le No. 711 Haussknecht, It. Orient, Pir Omar Gudrum, Juin 1867." 4 éch. bien maltraités par les insectes!

Distribution.—In the following an attempt is made to define the areas of the genus and its species. Unfortunately it is at present impossible to make full use of the material preserved in foreign collections so that the account must necessarily remain incomplete.

1. **P. Tournefortii**, discovered in Armenia, probably in the neighbourhood of Erzerum by Tournefort in 1701.

Specimens seen or recorded. Turkish Armenia: Upper Chorok valley, near Masut, E. of Baibut, 1200–1800 m., *Huet de Pavillon*! Near Erzerum, Zohrab, 826! *Calvert* and *Zohrab*, 158! Kurdistan; without precise locality, *Brant*! *Barre de Lancy* (Hb. Gaillardot, 2555). Transcaucasia: Near Pusko in the Dshagri valley, north of Nahitshewan, on *Pyrethrum myriophyllum*, C. A. Mey., *Buhse*.

2. **P. Boissieri**. Discovered by Boissier and Pinard on Mt. Cadmus (Baba Dagh) near Denislu in S.W. Asia Minor in 1842.

Specimens seen or recorded. Asia Minor: Vill. Aidin, Baba Dagh, above Denislu, *Boissier, Pinard*. Vil. Adana, in oakwoods in the "Kassan Oglu" Mts. near Gorumse, north of Si, 1200 m., *Kotschy* 44! Syria: On the summit of Djebel Akra (Mons Cassius), 1769 m., *Boissier*. Turkish Armenia: without precise locality, *Sintenis* (1899) No. 406! North of Van, *Maunsell*! Norduz District, *Maunsell*!

Anoplanthus coccineus var. *nigrovittatus* was discovered in 1867 by Haussknecht on the mountain Pir Omar Gudrum, north of Sulimanieh in S.E. Kurdistan. Since then the same variety has been recorded from the following localities: Caucasus, Gouv. Eriwan, St. Eyliar, on *Pyrethrum myriophyllum*, Thomin (in Acta Hort. Tifl. vi. II. (1902) 56); Gouv. Karabagh, Lisogorsk, west of Schuscha, *Thomin* l.c. iii. (1899) 65.

3. **P. foliata.** Discovered by Güldenstedt in Kachetia in 1772. Specimens seen or recorded. Crimea: in the subalpine region (Tchichatcheff) "Sobla" Estate, on the Alma River, *Marschall*; sources of the Salgir River, near Yenisala, on *Centaurea Scabiosa*, *Steven*; without precise locality, *Pallas*, *Arnoldi*. Caucasus: Gouv. Stawropol, between Moskowskoje and Alexandrowsk, *Marschall*; near Stawropol, *Akinfiew*. Terek Territory, near Pjätigorsk, *Hofft*; Constantinogorsk, *C. A. Meyer*; "Caucasian baths," *Conradi*, (acc. to C. Koch); Beshtau Mountain, *Hofft*; on *Centaurea dealbata*, *Peroffsky*, *Hohenacker;* Daghestan and Shirwan, without precise localities, between 1400 and 2100 m., *Marschall*. Gouv. Tiflis: Mzchet, *Thomin*; "Kachetia," *Güldenstedt*; without precise locality, *Steven*! *Wilhelms*! *Hohenacker*! Gouv. Jelisawetpol, near Helenendorf, *Hohenacker*! Mount Sariah, *Hohenacker*. Karabagh, without precise locality, *Hohenacker*. Gouv. Eriwan, "Armenia Rossica," *Szowitz in Herb. Besser* at Kew. Ararat and Alagos, 1300–1525 m. *Wagner* (acc. to Tchichatcheff).

Bornmüller in Bull. Herb. Boiss. sér. 2. iv. (1904) 687, quotes two more localities for "*P. coccinea*"—which as understood by him, would coincide with the genus—namely, Babadagh near Tabriz, and Ateschbeg between Maraga and Takt-i-Soleiman, both in Azerbeidjan, Persia. No specimens of either of the localities have been seen, so that their determination remains for the present uncertain.

The area of the genus may therefore be described as extending from the south-west of Asia Minor to Azerbeidjan and from the Crimea and the outlying hills on the north side of the Caucasus to Northern Syria. Of the three host plants so far recorded, *Centaurea Scabiosa* and *C. dealbata* extend over the whole of the Caucasus region, but in the Crimea only *C. Scabiosa* occurs, whilst neither of them is recorded from the areas of *P. Boissieri* and *P. Tournefortii*, unless they overlap slightly in Turkish Armenia. Similarly *Pyrethrum myriophyllum*, the only host plant known of *P. Boissieri* and *P. Tournefortii*, is almost entirely excluded from the area of *Phelipaea foliata;* but on the other hand it does not quite cover the area of *Phelipaea Boissieri*, as it neither reaches to the Taurus nor the Lebanon system. In Caria Boissier and Pinard are stated (Reuter in DC. Prodr. xi. 42) to have found *Phelipaea Boissieri* growing on a species of *Centaurea*. Boissier's *Anoplanthus coccineus* var. *nigrovittatus* is also said to grow on *Pyrethrum myriophyllum* in Transcaucasia, and both plants have also been collected on Pir Omar Gudrum.

Duration and cultivation.—F. E. L. Fischer, in "Notice sur les Anoplanthus de l'ancien monde" (in Bull. Soc. Nat. Mosc. 1852, pp. 105–108), says that the examination of spirit material collected by Count L. Peroffsky on Beshtau proved the perennial character of the plant, the bosses caused by the action of the parasite on the host showing at the same time flowering stems, scars of the preceding year's growth and buds for the next year (see pl. I.).

PHELIPAEA FOLIATA.

[*To face page* 294.

THYRSOPTERIS ELEGANS.

To face page 295.]

Attempts to grow the brilliant parasite have been made repeatedly, but the only instances of successful cultivation, previous to its flowering at Kew, seem to have been those recorded by F. E. L. Fischer l.c. and E. Regel and Poscharsky in Gartenflora, 1880, pp. 34, 35. The former states that a horticulturist at Kharkow succeeded in obtaining a flower out of a ball of earth which he had received from the Caucasus. No particulars of the case are given. Poscharsky, Curator of the Botanic Garden at Dresden, on the other hand, is more explicit. He relates that in 1876 he received specimens of *P. foliata* from C. Koch from the Caucasus, some of which were connected with portions of the host plant (*Centaurea dealbata*), and showed signs of life. They were planted out, and four weeks later the host plant began to sprout. There was, however, no sign of the parasite until June, 1879, when two flowering stems were produced.

The history of the plant grown at Kew and illustrated in the plate accompanying this article is related thus in the text for tab. 8615 of the Botanical Magazine:—

> "The plants on which our figure has been based were grown at Kew from seeds received from the Botanic Garden, Tiflis, in 1911. In this case the host-plant was *Centaurea dealbata*. The seeds of host and parasite were sown together in a pot, but only the *Centaurea* came up. Later, in 1911, the *Centaurea* was planted in the Rock Garden, where it grew alone until, in May, 1914, seven stems of the *Phelipaea*, each bearing a solitary flower-bud, made their appearance, the first bud to open doing so in the middle of the month."

Vernacular names.—**P. Tournefortii.**—Kardush Kâni (Turk. = brother's blood), *Noe*, *Maunsell*.

P. foliata.—Bucha-tschitschegi (Tat. = stallion flower).

XXVI.—THYRSOPTERIS ELEGANS.

L. A. Boodle.

(With Plate.)

Thyrsopteris elegans is a Tree Fern of an interesting type, which is rare in cultivation, and is native only in Juan Fernandez, where it grows in moist and shady woods on the mountains.

The stem is upright, covered with the scars of the old leaves, and may reach a height of 5 feet. The leaves, which form the crown, may be 6 feet or more in length, and the petiole may form half of the length or more. The petiole and rachis are at first clothed with a felt of soft brown hairs among which are interspersed stouter trichomes resembling rather fine bristles. The leaf is pinnately decompound (four to five times pinnate), and is exceptional in being sharply differentiated into sterile and fertile portions, which are quite dissimilar. Some of the lowest pairs of pinnae of the second order, that is those nearest to the rachis, are fertile, and show no expansion of laminar surface in their subdivisions. The ultimate divisions or pinnules, which are there-

fore rachiform, bear the sori terminally, so that each pinnule looks like the stalk of a sorus. The branching of the fertile pinnae, though similar in degree to that of the sterile pinnae, is somewhat contracted, and departs from the horizontal plane in such a way as to assume a thyrsoid character, to which the name of the genus refers.

A cup-like basal indusium invests the sorus, which consists of numerous sporangia covering a prominent receptacle. The sporangium has a continuous, oblique, irregular annulus with no definite stomium. The sporangia are developed on the receptacle in basipetal order.

The genus *Thyrsopteris* was established in 1834 by Kunze* to receive this species, which till then had not been described, though specimens were collected by Bertero in 1830. *Thyrsopteris* was referred by Kunze to the *Cyatheaceae*†, and its affinities are still held to be with certain members of this family. In Hooker's Species Filicum (1846) *Thyrsopteris* was placed next to *Dicksonia*, but in the Synopsis Filicum (Hooker and Baker, 1868) it was transferred to a position next to *Cyathea*, while Diels (in Engler and Prantl, Natürl. Pflanzenfam.) makes a tribe (*Thyrsopterideae*) for it between *Dicksonieae* and *Cyatheae* in the *Cyatheaceae*. Bower‡, who has studied the development of the sorus and sporangium, holds that the characters of *Thyrsopteris* indicate a relationship to *Dicksonia*, though not a very close one, and favours the view that the *Thyrsopterideae* should rank as a separate family. The indusium at an early stage is slightly two-lipped, which is an indication of correspondence with *Dicksonia* (*Cibotium*). A somewhat archaic character is recognised in certain structural features of the annulus.

The occurrence of fertile and sterile tracts of very different appearance on the same leaf, though a rather rare phenomenon, is not restricted to a small phyletic series of Ferns, but is met with again in genera far removed from *Thyrsopteris*, viz.: *Osmunda* and *Aneimia*.

Thyrsopteris is a monotypic genus as regards living plants. Among fossil plants some Ferns of Jurassic, Wealden and Cretaceous age have been referred to this genus by certain authors, but it appears that the data obtained were not sufficient in any of these cases to warrant so precise an identification§.

Ferns form an important constituent of the Flora of Juan Fernandez, the species of Ferns recorded (45) amounting to nearly a third of the vascular plants. Of the Ferns, six besides the *Thyrsopteris elegans* are endemic species.

The large specimen in the Temperate House, a frond of which is illustrated in the accompanying plate, has been at Kew for many years, and its exact history is not on record. It thrives in a mixture of peat and loam placed between rough stones and enjoys a position where it obtains plenty of moisture and some shade.

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* Kunze, Linnaea, vol. ix, p. 507.

† Bertero appended a note to his specimens as follows:—"*Cyathea*? an potius *Aneimeae* species nova n. 1537."

‡ Bower, The Origin of a Land Flora, 1908, p. 589.

§ See Seward, Fossil Plants, vol. 2, p. 368 etc.

XXVII.—THE SOUTH AFRICAN CAMPHOR TREE.

(*Cryptocarya vacciniifolia*, Stapf.)

O. Stapf.

A tree known in South Africa as "Camphor tree" has recently been received for identification from Mr. I. B. Pole Evans, Chief of the Division of Botany, Department of Agriculture, Pretoria, and proves to be a new species of *Cryptocarya*, closely allied to *C. myrtifolia*, Stapf. The tree was discovered in the Wolf River Forest by Mr. J. D. Keet, Acting Assistant District Forest Officer, and the specimens sent to Kew were accompanied by concise notes, which have been of considerable assistance in drawing up a proper description of the tree, and have furnished the basis of the following information.

The tree is at present known to exist only in the Wolf River Forests and part of the adjoining Schwarzwald Forest, though a few specimens have been found in Flo Forest. It forms a fair percentage of the stocking in Wolf River, and is chiefly confined to ridges, but it may also be found at all elevations between 2500 and 4500 feet. The soil where it flourishes is a deep, rich, red dolerite loam. *Cryptocarya vacciniifolia* forms a tall tree, 80–90 feet high, with clean straight boles up to 60 feet in the best specimens and a diameter at breast height up to $2\frac{1}{2}$ feet. The crowns are dense, well shaped and picturesque. Here and there specimens have outgrown the Yellow-wood, Black Ironwood and other trees, and have their crowns fully exposed to the light. Natural regeneration from seed is fair, and all sizes from the seedling stage are found. Straight and rapid-growing adventitious shoots often form on the stem, and may reach 3 to 4 inches in diameter. The bark of young trees and the higher parts of old stems is dark, and resembles that of Black Bark (*Royena lucida*); ultimately it turns greyish, and is then easily confused with that of large-sized White Pear. The tree flowers profusely; the flowers are inconspicuous, but honey bees visit the tree when in flower in large numbers.

The boles are generally sound and of good shape, but are often somewhat fissured towards the base. There is a perceptible smell of camphor emanating from the leaves, bark, twigs and young wood during the dry season and a few days after felling in the rainy season. The timber is not known to have been put to any use up to the present. It splits easily like Assegai (*Curtisia faginea*) and White Pear (*Apodytes dimidiata*) in the green state, and is straight-grained. It is probably not sufficiently strong to be used for spokes, felloes, or other wagon timber, but it should prove exploitable for furniture.

There were up till now 6 species of *Cryptocarya* known from South Africa, one of them confined to the extreme South-West of Cape Province, the others occurring in Natal and Zululand, except *C. Woodii*, which extends westwards as far as King Williamstown Division. Of most of these very little is known, and the herbarium material extant is extremely scanty. It is therefore very desirable that more attention be paid to these

representatives of *Cryptocarya*, some of which will probably be found to be of economic value. Sim describes the wood of *C. Woodii*, Engl. (*C. acuminata*, Schinz) as hard and close-grained, and mentions another undescribed tree, frequent in E. Pondoland and Natal, which grows up to 60 feet in height and 3 feet in diameter. It is locally known as "Umtungwa," but so far no material has been supplied for scientific examination. It should be kept in mind that the foliage is more or less variable in the same species, according to the age or the parts of the tree. Leaf branches should therefore be collected from young trees, from the flowering region of old trees and from adventitious shoots.

The description of the tree is as follows:—

Cryptocarya vacciniifolia, *Stapf* [Lauraceae]; *C. myrtifoliae*, Stapf, proxima, sed foliis minoribus minus acutis vel obtuse acuminatis supra medium latissimis subtus glaucis paulo brevius petiolatis, floribus et fructibus paulo majoribus distincta.

Arbor circiter 25 m. alta; ramuli juveniles graciles, fulvo-pubescentes, tandem glabrati, cortice nigro tecti. *Folia* obovata vel late obovato-lanceolata, basi subcuneata, apice breviter obtusiuscule acuminata, 2–3 cm. longa, 1–1·4 cm. lata, coriacea, primo utrinque fulvo-pubescentia, cito glabrescentia, tandem pilis paucis subtus circa areolas relictis supra imprimis in costa persistentibus, nervis lateralibus tenuibus utrinque 4–5, reticulatione arctissima supra foveolato-exsculpta; petiolus 2–4 mm. longus. *Paniculae* terminales, 1–1·25 cm. longae, densiusculae, ramulis paucifloris e foliorum 3 vel 4 proximorum axillis auctae, fulvo-pubescentes; bracteae caducae; bracteolae obsoletae; pedicelli ad 1 mm. longi. *Perianthium* campanulatum, 3·5–4 mm. longum, extus totum fulvo-cinereo-pubescens; receptaculum intus in lineis a staminodiis decurrentibus dense pallide fulvo-tomentosum, caeterum glabrum; segmenta ovato-oblonga, subacuta, intus praeter margines latos tenues minute fulvo-pubescentes. *Staminum* filamenta tenuiter pubescentia; antherae breviter apiculatae; glandulae majusculae, globosae, tenuiter stipitatae. *Pistillum* glabrum. *Fructus* globosus 1–1·3 cm. diametro.

South Africa. Cape Province: King Williamstown Division; Wolf River Forests, *Keet* 1432.

XXVIII.—THE ARBORETUM AT TORTWORTH.

W. J. Bean.

The collection of trees growing in the grounds of Tortworth Court, the home of the Earl of Ducie, has long been known to those interested in trees as one of the finest in the British Isles. It has several claims to distinction. The trees are admirably cultivated, the number of species grown is large, and many rare species are here represented by the finest specimens of their kind in England—often in Europe. There is also an interesting personal factor in the collection being entirely the work of the present Earl of Ducie, who has been an assiduous planter for

sixty or more years. To very few has it been vouchsafed to see such splendid results of their own work. Personally, I know no scene of its type more attractive than that which greets the eye on passing out of the house at Tortworth—smooth, far-spreading lawns, on which are grouped in excellent taste a collection of trees unequalled probably in any private demesne for rarity, diversity and vigour.

The house is situated on an eminence sloping down on one side to a long winding lake bordered by steep, tree-clad slopes, and on the other to a deep ravine with a stream at its base. The grounds occupied by Lord Ducie's trees rest chiefly on two geological formations, the one mountain limestone, the other old red sandstone, the two being divided by the stream just mentioned. There is thus a useful choice of sites. The soil overlaying the sandstone is admirable for ericaceous plants, amongst which a large number of rhododendrons are in great vigour.

Oaks.—Perhaps no genus of trees is so extensively represented at Tortworth as *Quercus*. Unhappily, it has long since ceased to be the fashion to plant exotic oaks, and owing to this neglect nurserymen do not find it worth while to stock representative collections such as one might have found in older days at establishments like that of the Lees of Hammersmith and Isleworth, Smith of Worcester, or Booth of Hamburg. In the greatly revived interest that is being taken in trees now we may hope to see the oaks again planted. The beauty and diversity of their foliage, their often rich autumnal colouring, together with their noble dimensions and their longevity render them very attractive and appropriate ornaments for large gardens and parks. Mr. Vicary Gibbs has got together an extensive collection at Aldenham, but many are yet comparatively small. And at Kew there is a collection unequalled, so far as I know, either at home or abroad in the number of species and varieties, but the Kew soil is too light and dry for oaks as a whole. So that neither at Kew nor at Aldenham do the rarer exotic species show to such advantage as at Tortworth.

Perhaps the rarest of oaks represented at Tortworth is the Japanese *Quercus glauca*, an evergreen species with leaves glossy green above, glaucous white beneath, and about as large as those of Portugal laurel. It is not uncommon to find plants under the name in gardens, but they are nearly always *Q. Vibrayeana*. There are two bushy trees of the true species at Tortworth; they are of rounded habit, the larger one 22 feet through and perhaps as much high, undoubtedly the finest in this country. Another interesting evergreen oak is *Q. agrifolia*, a Californian species of the same type as *Q. Ilex*, but with leaves prickly-toothed and glossy green beneath. A tree at Tortworth, raised from acorns sown in 1879, is now about 35 feet high, 3 feet 9 inches in girth of trunk, and of rather columnar form. *Quercus macedonica* is a rare and distinct oak, deciduous, but usually retaining its leaves until the New Year. It is represented by several plants at Kew, healthy but slow-growing. Lord Ducie's tree is no doubt the largest in England, being now 30 to 35 feet high and 2 feet 11

inches in girth. As indicating the rate of growth at Tortworth, it may be mentioned that in 1907 this tree girthed 1 foot 11 inches. *Quercus Kelloggii* is a handsome oak from Oregon and California, represented here by two fine specimens, one 4 feet 5 inches, the other 4 feet in girth of trunk. Sown in 1879, they are now 50 to 60 feet high, and growing rapidly. There is a smaller tree at Kew from whose acorns young trees have been raised. This interesting tree appears to represent the red oaks in Western North America, having similarly large, deeply lobed leaves, and turning a fine red colour in autumn. Other well-grown American oaks at Tortworth are *Q. palustris*, the pin oak, 6 feet 3 inches in girth, and several *Q. imbricaria*, the shingle oak, about 50 feet high and over 3 feet in girth of trunk. There is a clump of the small-growing *Q. ilicifolia* (syn. *Q. Banisteri*), an oak which produces amazing crops of acorns and has on that account been recommended for pheasant covert. *Q. alba*, the common white oak of the Eastern United States, of which some noble specimens can be seen in the Arnold Arboretum and other suburbs of Boston, Mass., is one of those East American trees which cannot apparently be made to succeed in the British Isles. Lord Ducie has a tree believed to be the largest in the Kingdom, but it is only about 20 feet high and is chiefly remarkable at Tortworth for an obvious lack of vigour amidst so much abounding health.

The two European oaks with finest foliage are *Q. conferta* and *Q. Mirbeckii;* at Tortworth one of several examples of the former has a trunk girthing 6 feet 9 inches, and there is one of *Q. Mirbeckii* 6 feet 3 inches in girth. Lord Ducie finds that this oak grows twice as fast in sand and clay as it does on limestone. There is an interesting hybrid here between *Q. Toza*, a South European species with woolly leaves and young shoots, and our native common oak, *Q. pedunculata;* it is now about 28 feet high. Another European oak received by Lord Ducie as "*Q. serratifolia*" was long a puzzle to botanists; it is now regarded as one of the numerous forms of *Q. lusitanica*. The Valonia oak, *Q. Aegilops*, remarkable for its very large acorns and for the acorn-cups which were once an important article of export from the Levant to this country for tanning purposes, is represented by a tree 40 feet high and 3 feet 5 inches in girth of trunk.

Cupuliferae.—A few notes may be given appropriately here to other members of the Natural Order *Cupuliferae*. There is no tree at Tortworth with a more dainty appearance than *Nothofagus obliqua*, one of the "beeches" from the southern part of South America. Two specimens are in the collection, both raised from the seed introduced from Chile by Mr. H. J. Elwes in 1902; the larger one, a slenderly pyramidal tree of perfect shape, approximately 35 feet high, has a bole clean for about 6 feet at the base, and now 2 feet 1 inch in girth. Although this tree had previously been introduced more than once, it never appears to have become established in gardens, and there is still a possibility that a recurrence of frosts like those of February, 1895, may seriously reduce the number of the trees that at present make so pleasing a feature in many gardens. *Fagus ferruginea*,

although an interesting representative of the genus in North America, has rarely in this country proved worth its room in gardens. Even at Tortworth it makes, like *Quercus alba*, an exception to the general aspect of vigour and health that characterise the tree growth there, although it is one of the best in the Kingdom. It is a low, flat-topped tree with a head of branches 30 feet across and a trunk girthing 3 feet. The North American beech is well distinguished from the European one by its habit of producing suckers from the roots (like an elm) and by the more numerous ribs in each leaf.

Carpinus cordata, a native of China and Japan, has very large leaves for a hornbeam; they are occasionally as much as $5\frac{1}{2}$ inches long by $3\frac{1}{4}$ inches wide, deeply cordate at the base. The species is extremely rare, and except possibly for a tree which grew in the Coombe Wood Nursery, the finest tree in the country is at Tortworth, now about 20 feet high and 10 inches in the circumference of its trunk.

Of alders I noted two fine trees. One of them, *Alnus cordifolia*, perhaps the handsomest of all alders, is over 60 feet high and has a bole 5 feet 9 inches in circumference. An example of the cut-leaved alder, *A. glutinosa* var. *laciniata*, has a trunk 6 feet 6 inches in girth.

A healthy specimen of *Betula papyrifera* has a beautiful white trunk 5 feet 1 inch in girth and is about 45 feet high. Another of *B. Maximowiczii* is probably as good as can be found in Britain. This Japanese species has the largest leaves of all birches, and is a promising tree in this country. Lord Ducie's tree is 2 feet 4 inches in girth and 45 to 50 feet high.

The Golden chestnut.—There is no exotic tree in the Tortworth collection so famous as the Golden chestnut, *Castanopsis chrysophylla*, almost unique among hardy trees for the tawny covering beneath the leaves. This tree, a native of California, is growing on the opposite side of the ravine from the house, on the old red sandstone formation, where it was planted by Lord Ducie almost exactly sixty years ago. It is a shapely, round-topped tree with a smooth trunk. According to Mr. Elwes this tree in 1879 was 20 feet high and 1 foot 5 inches in girth; in 1897 it was 27 feet high and 3 feet in girth of trunk. Since then it appears to have grown more slowly, for fourteen years later (1911) it had only reached 29 feet in height by 3 feet 5 inches, and on May 28 last I made it 3 feet 7 inches in girth, but it seemed to me well over 30 feet high. During the last thirty years it has borne fertile seeds, and many of its progeny are scattered over the country. Several are at Kew, the finest of them standing about forty yards due west of the pagoda at the edge of a bed of heaths; this tree, planted about 1904, is now 18 feet high, its trunk 1 foot 11 inches in girth. It seems to be certain that this *Castanopsis* will not thrive where there is much lime in the soil.

Conifers.—Probably the most striking success among conifers at Tortworth is a tree of *Abies nobilis* planted by Lord Ducie in

1854. In May, 1908, it was 104 feet high by 9 feet 11 inches in girth, but since then its top has been blown off, and it is probably no higher now. Its trunk is 10 feet 7 inches in girth at the present time. There are, however, other fine examples of *Abies nobilis* in our islands, especially in Scotland. Much more interesting to me was a most notable specimen of *Torreya californica* (syn. *T. Myristica*), often called "Californian nutmeg," from the resemblance of its seeds to common nutmegs. This tree is about 35 feet high and about 40 feet in diameter. Its trunk, which girths 5 feet 7 inches, is quite erect and tapering, the side branches spread slightly above the horizontal plane, and the branchlets are perfectly pendulous. This, the finest of Torreyas, was discovered in California by Wm. Lobb in 1851. Of the now comparatively rare *Pinus Sabiniana*, there are two trees, one of them very lofty, and both with the thin, shadeless furnishing of leaves characteristic of this pine. In the bulk of timber they contain the Tortworth trees must be among the most notable in the country. A specimen of the glaucous or silver-leaved variety of Mount Atlas cedar, 60 to 70 feet high and about 40 feet in diameter near the ground, shows how beautiful and effective a tree this is for gardens. According to Lord Ducie, there has been a considerable mortality amongst the deodars planted by him at Tortworth in and subsequent to the year 1854, the reason for which is not very apparent, as those that remain are very healthy and remarkable for their dense heavy masses of foliage. *Larix leptolepis*, the Japanese larch in which foresters are now taking so great an interest, is represented at Tortworth by probably the largest tree of its kind in Britain. It is, I should say, 55 to 60 feet high, its trunk 5 feet 1 inch in girth. *Larix occidentalis*, the North-Western American larch, is also succeeding well. For the drier parts of our islands this is a tree of great promise. Of the beautiful Golden larch of China, *Pseudolarix Fortunei*, there is at Tortworth one of the most notable trees in Britain. I made it 40 feet high and 4 feet 4 inches in girth of trunk. Of *Prumnopitys elegans*, that curious ally of the yew, native of Chile, there is a fine bush about 20 feet high which bears its yellowish white, plum-like fruit. We have lately received at Kew fruits of this taxad from two places in Ireland, but it has not borne them in many places in England. There is a good example of *Juniperus excelsa* about 36 feet high and one of the redwood (Sequoia sempervirens).

Maples.—The genus *Acer* is represented at Tortworth by a collection of remarkably well grown trees. The rare Japanese *Acer nikoense* is perhaps 15 feet high, very shapely and graceful; it is one of the maples with trifoliolate leaves, covered with greyish down, especially beneath. Another uncommon Japanese species, *A. diabolicum*, has a trunk 2 feet in circumference and a rounded head of branches 25 feet in diameter. The specific name is said to refer to the horn-like persistent styles that remain attached to the fruit. The true *Acer pictum* is a native of Japan, but the fine trees at Tortworth grown under the name are probably its Caucasian representative, which is sometimes known as

A. pictum var. *colchicum*, sometimes as *A. laetum*. One of the trees I measured has a rounded head of branches 40 feet in diameter and a short trunk girthing 5 feet 2 inches at its narrowest. *Acer rufinerve*, another Japanese maple, is a very fine tree, probably 35 to 40 feet high, its trunk 2 feet 5 inches in circumference. Its foliage often turns rich crimson before falling. This maple is nearly allied to, and may be regarded as the Japanese representative of, *Acer pennsylvanicum*, a North American species of which also there is a tree at Tortworth of about the same size as regards its trunk. The tree has a peculiar attractiveness in the young wood being striped with conspicuous blue-white jagged lines. There is a good specimen of the rare *A. argutum*, introduced from Japan by Maries in 1881. *Acer spicatum*, introduced from Eastern N. America as long ago as 1750, does not thrive well as a rule in this country, and it is now quite uncommon; but Lord Ducie has it 15 feet high. Very few maples are equal in size of leaf to *A. Volxemi*, and a tree at Tortworth with a trunk nearly 3 feet in circumference has many leaves 12 to 14 inches wide. *Acer Opalus* is not a very rare maple, but there is one of the best in the Kingdom at Tortworth. It has a broad, dense, spreading head of branches and a trunk 6 feet 8 inches in girth.

Lord Ducie has been one of the few to appreciate the merits of the Indian horse-chestnut (*Aesculus indica*). There are several trees thriving well. It is one of the finest of all hardy fine-foliaged trees and is valuable in flowering four or five weeks later than the common horse-chestnut. So far as foliage is concerned, however, no *Aesculus* equals *A. turbinata*, the Japanese species, which is also here in thriving condition. There are five or seven leaflets to each leaf, and the largest of them are as much as 16 inches long by 6 inches wide. The tree, however, is not free-flowering.

Of hickories and walnuts there are some interesting examples. *Carya alba*, the shellbark hickory, has a bole girthing 4 feet, and is already showing the characteristic loose strips of bark. *Carya tomentosa* and *C. sulcata* are both rare, the latter extremely so, but it has borne nuts at Tortworth. One of the most attractive of the walnuts for its foliage is *Juglans rupestris*; it is often a shrub rather than a tree, and here the plant—a bush 30 feet in diameter—is broader than it is high. The leaflets of this species are the smallest among walnuts. *Juglans cinerea*, although introduced (like *J. nigra*) early in the 17th century, is still a very rare tree with us, and is apparently less suited to our climate than the black walnut, but at Tortworth there is a healthy tree with a trunk 3 feet in girth. Allied to the walnuts is the genus *Pterocarya*. *P. caucasica*, is represented by a handsome and shapely tree, not so large as the famous tree at Claremont, but with a trunk 5 feet 10 inches in girth. This is not a common tree in gardens, but very much rarer are *P. rhoifolia* and *P. stenoptera*. Both are in excellent condition here, the former 40 feet, the latter 35 feet high, the trunk of each being 3 ft. 3 inches in circumference.

Of *Tilia euchlora*, a handsome tree is approaching 50 ft. in

height and is 3 ft. 9 in. in girth. In many respects this is the best of all limes. Its branches are rather pendulous and its dark green leaves are remarkably glossy and clean looking. *Cercidiphyllum japonicum*, usually rather disappointing in this country, is 25 ft. high at Tortworth, and thriving. *Cornus controversa* (commonly but erroneously named *C. brachypoda* in gardens) is 20 ft. high, very distinct in its horizontal branching. Of *Acanthopanax ricinifolium*, a remarkable araliad becoming 80 ft. or more high in North Japan, but of which few plants have succeeded for any length of time in England, Lord Ducie has a promising young tree 25 to 30 ft. high, its trunk girthing 23 in. breast high, 3 ft. 1 in. at the base. *Maclura aurantiaca*, the Osage orange, is generally considered to be dioecious, but a tree at Tortworth—the only one there—has borne fruit. *Magnolia acuminata*, the so-called cucumber tree of North America, is represented by a very elegant tree 50 ft. high. Another interesting American tree, the tupelo (*Nyssa sylvatica*), is thriving well with the boggy condition at the root which it affects in its native country. This tree is worth growing for its autumn colour. In the park is probably the best example in Britain of the blue ash (*Fraxinus quadrangulata*) so distinct in its square four-angled stems. Ten years ago this tree was 34 ft. high and 1 ft. 10 in. in girth of trunk. Now it is about 40 ft. high and 2 ft. 8 in. in girth.

For the thorough study of the Arboretum at Tortworth several full days would be needed. The notes on which this paper is based were hurriedly taken during a visit of a few hours on May 28th, 1915. The girths given are correct, but the heights are approximate, there being no time to use a dendrometer. But I tried to avoid the usual fault of exaggerating the stature of the trees.

To conclude, a few words must be given to the celebrated Tortworth chestnut (*Castanea sativa*) now a ruin, but a magnificent and by no means a lifeless one. It stands near the site of old Tortworth Court and the Church. Owing to the rugged and uneven character of its trunk it was not easy to measure accurately, but I made the narrowest girth 51½ ft., equal to about 5½ yards in average diameter. According to legend, King John held council under it, and even in King Stephen's reign Evelyn says it was known as the Great Chestnut of Tortworth. Little is left now but the remains of its gigantic bole, the upper part of which bears a thin furnishing of leaf-bearing branches, and occasional fruits.

XXIX.—THE BLACK OR BERRY-BEARING ALDER FOR GUNPOWDER.

(*Rhamnus Frangula*, L.)

W. Dallimore.

A good many complaints have been made during recent years regarding the poor prices obtained for coppice wood and the difficulty experienced in finding a market for some kinds, yet there are certain coppice woods that are not produced in sufficient quantity to supply the demand, and adequate steps do not appear

to have been taken to replace plantations of unremunerative trees by more promising species.

Rhamnus Frangula is a case in point, for, although wild in the southern parts of the British Isles and at one time cultivated to some extent, it has been impossible for many years to secure the required quantity of wood in this country, and importations have been made from Belgium and Germany. The value of the wood at the present time will be appreciated from the fact that when carbonized, the charcoal is recognised as one of the most important of all charcoals used in the manufacture of explosives, its inflammable character making it peculiarly useful as an ingredient for smokeless powder.

Even before the commencement of the present war, manufacturers experienced a difficulty in securing the necessary amount of wood; therefore, there appears to be good reason for landowners in this country, and particularly in the home counties, laying down plantations to replace coppice, which at present hardly pays working expenses.

Under normal conditions *R. Frangula* is found as a bush 6 to 15 feet high with upright branches, or sometimes as a small tree 20 feet high, with a trunk 6 to 9 inches in diameter. The leaves are deciduous, bright green, oval, and 2 to 3 inches long by 1 to 1½ inches wide. The flowers are greenish-yellow and borne in May, and they are followed by small, round fruits, which are alternately red and black when ripening.

Tall, straight shoots with few side branches are most approved for charcoal, and such shoots may be from ½ an inch to 2 inches in diameter; larger wood can be used, but it is usually passed over in favour of the smaller sizes. The wood is either cut in spring when the sap is flowing freely, or in winter when at rest. In the former case the bark is peeled off at once as is done with spring-cut willows, but in the other instance the wood is boiled or steamed before peeling. Great care is taken to keep the newly-peeled wood free from dirt, and provision is made so that it does not come in contact with the ground, for any foreign matter has to be thoroughly cleaned away before the wood can be used. The wood is usually sold to the powder factories as soon as it is peeled, and in normal times the purchasers keep it for a period varying from one to three years before turning it into charcoal. To keep it clean during the process of seasoning it is often stacked and thatched, in the same way as hay or corn, as soon as it arrives at the factories. The exclusion of particles of sand and grit from the charcoal is of vital importance; therefore, after being thoroughly cleaned, the wood is placed in a closed cylinder for carbonization, heat being applied from outside. It is difficult to say what the wood is worth at the present moment, but a few years ago it was quoted at from £10 to £14 a ton.

The most suitable soil for *R. Frangula* is a moderately good loam, but as a rule it may be expected to thrive where the hazel grows well. Propagation should be conducted by means of seeds sown in boxes in a cold frame or in beds of well-drained soil out-of-doors. The young plants should be placed 6 inches apart in nursery rows 1 foot apart, and, when about 9 inches high, they

should be cut back to induce several branches to appear from near the ground line. When the young plants are from 12 to 18 inches high place them in permanent positions at intervals of from 4 to 5 feet, on ground that has been well broken up. From six to eight years rotation will probably be found most suitable for the crop, though position and soil may make a year or two difference either way. An open position exposed to south or west is considered to be most favourable. When cutting a plantation over, care should be taken to cut the branches as close as possible to the root stock; otherwise long, objectionable spurs will be formed. In the event of a large number of shoots being produced from cut-over plants, it is wise to remove all unnecessary ones during the first year. Growth is facilitated by keeping the ground free from coarse weeds and by working between the plants occasionally with a cultivator whilst they are small. Should signs of deterioration appear in the vigour of the branches, a dressing of bone or some other manure may be applied to the land, for a little money spent in this way will be amply repaid by increased yield.

It is doubtful whether a large stock of plants could be procured in the British Isles at the present time, and the catalogue price for single plants places the few which are available outside the bounds of practical forestry; it would therefore appear likely that anyone wishing to undertake the cultivation of this plant would need to commence by sowing seeds. The fruits may be collected during August or September and placed in sand to separate the seeds from the flesh, sowing the seeds and sand together during the early spring. People who already possess large or small plantations might find the present time an excellent one for marketing the produce.

In some parts of the country *R. Frangula* is known as dogwood, but it is quite distinct from the true dogwood, *Cornus*, which makes an inferior charcoal, and the two plants must not be confused.

XXX.—MISCELLANEOUS NOTES.

Mr. M. T. Dawe, F.L.S., formerly a member of the gardening staff of the Royal Botanic Gardens, and lately Director of Agriculture, Portuguese East Africa, has been appointed, on the recommendation of Kew, Agricultural Adviser to the Government of Colombia.

Mrs. Badderley.—We record with sincere regret the death of Mrs. Badderley, caretaker of the North Gallery, on June 26th, at the age of 67. Mrs. Badderley acted as caretaker of the Gallery from the day it was opened to the public in June, 1882, until the end of last March, when failing health compelled her retirement. During the period of nearly 33 years' faithful service she had won the affection of all with whom she had been associated in the Royal Botanic Gardens.

Robert Heath Lock.—The death of Dr. R. H. Lock, D.Sc., on June 26th, is a severe loss to botanical and agricultural science. After distinguishing himself in the Natural Sciences Tripos at Cambridge, Lock devoted himself to the study of plant breeding, and in September, 1902, was appointed scientific assistant to the Director of the Royal Botanic Gardens, Peradeniya, Ceylon, where he was able to carry out his researches under tropical conditions. During his two years in Ceylon he undertook experiments in plant breeding with *Pisum sativum* and *Phaseolus*, with important scientific results, and also initiated some of the experiments in Maize which he developed in later years. His paper on the growth of the giant Bamboo *Dendrocalamus giganteus* was the outcome of a series of observations made during the year 1903. On October 1st, 1904, Lock resigned his post in Ceylon, having been elected a Fellow of Gonville and Caius College, Cambridge, and continued his plant breeding work at the University, where also he held the post of Curator of the Herbarium. He returned, however, to Peradeniya in 1908 to take up his duties as Assistant Director of the Royal Botanic Gardens, and commenced his new work on January 28th of that year.

The experiment work of the Agricultural Department at the Peradeniya Experiment Station was under his particular charge, and he devoted himself more especially to plant breeding work in Maize, Paddy and Tobacco, achieving useful and important results. He also commenced work on Coffee with a view to producing a race resistent to the ravages of *Hemileia*. His resignation of the Assistant Directorship, on November 20th, 1912, unfortunately prevented the continuance of this and other valuable research work on which he was engaged. Shortly after his return to England, he received an appointment as Inspector under the Board of Agriculture and Fisheries, and was actively engaged on the duties of his post when a sudden heart attack caused his untimely death.

Kew and the War.—Since the publication of the last note in *K. B.* 1915, p. 96, seventeen more employees of the Royal Botanic Gardens have enlisted or re-enlisted. Nine members of the uniform section, including Corporal Constable J. Sealy and Laboratory Porter J. A. Mingay, have re-enlisted, the two latter to serve in the Army Ordnance Corps; three labourers, a carter and four young gardeners, including one of the sub-foremen, have enlisted. As two men have been discharged as unfit, the number of Kew employees serving with His Majesty's' Forces is now ninety-two. One young gardener has recently received a commission.

Botanical Magazine for May.—The plants figured are *Gentiana barbata*, Froelich, forma *grandiflora*, Freyn (t. 8609); *Zygopetalum Prainianum*, Rolfe (t. 8610); *Amelanchier florida*, Lindl. (t. 8611), and *Primula pycnoloba*, Bur. et *Franch.* (t. 8612).

The Gentian is a showy biennial which was raised from seed received from the Royal Botanic Garden, Edinburgh, in 1912, and flowered at Kew in September, 1914. It is a native of Siberia and differs from the typical form, which is figured at t. 639 of the Botanical Magazine under the erroneous name of *Gentiana ciliata*, in having a larger corolla and longer more acuminate sepals. Its leaves are linear-lanceolate, up to $2\frac{1}{4}$ in. long and over $\frac{1}{3}$ in. broad, and its solitary flowers have a bright blue corolla $2\frac{1}{2}$–3 in. long, with four spreading lobes $1\frac{1}{2}$ in. long and 1 in. broad; these lobes are fimbriate below the middle and entire in the upper part and at the base.

Zygopetalum Prainianum is a Peruvian species recently discovered by Mr. L. Forget and introduced by Messrs. F. Sander and Sons, of St. Albans, in whose collection it first flowered in September, 1914. The plant was then purchased for Kew. It is a close ally of *Z. Burkei*, Reichb. f., a native of Mount Roraima in British Guiana, but it has larger pseudobulbs and leaves, and its showy flowers differ in colour, having fewer green markings on the petals.

Amelanchier florida is an old inhabitant of our gardens, having been introduced from Western North America by David Douglas in 1826. It is found in British Columbia, Washington, Oregon and Nevada, and extends eastwards as far as Michigan. In botanical works as well as in gardens it has often been confused with *A. alnifolia*, Nutt., but it differs in being a caespitose shrub instead of a small tree, its leaves are toothed farther down the margin, its hypanthium is woolly or even quite glabrous, and it flowers about a fortnight earlier. The Kew plant which furnished the material for the figure was obtained in 1906 from a Continental nursery as *A. oxyodon*, Koehne, a name which must be regarded as a synonym of *A. florida*.

Primula pycnoloba is a very distinct though scarcely an ornamental species which was raised by Messrs. James Veitch & Sons from seeds sent from Szechuan, Western China, by Mr. E. H. Wilson. The drawing was made from a plant presented to Kew by Messrs. Veitch in 1912. Pax and Knuth include the species in the same section as that to which *P. sinensis*, Sabine, belongs. The plant has large broadly cordate or ovate-cordate leaves and a downy scape up a 8 ins. long bearing a rather dense terminal raceme of small dark pink flowers, with a large hairy acutely-lobed calyx. Propagation is easily effected by means of root-buds.

Botanical Magazine for June.—The plants figured are *Aristolochia longecaudata*, Mast. (t. 8613); *Hippeastrum Elwesii*, C. H. Wright (t. 8614); *Phelipaea foliata*, Lambert (t. 8615), and *Dorstenia yambuyaensis*, De Wild. (t. 8616).

The *Aristolochia* was originally described from material collected by Mr. C. F. Appun in British Guiana, and first flowered in cultivation in 1890, when the late Dr. Masters received a flowering specimen from Mr. Todd, of North Cray, Kent. The plant from which the material for the figure was obtained was presented to Kew in June, 1913, by the Rev. A. Miles-Moss, who

found it in the State of Pará, Brazil. It has grown well in a tropical house and flowered for the first time in February, 1914. The flowers, as is usual in the genus, have a disagreeable odour, and are characterised by the dense patch of hairs in the throat of the long-tailed perianth, which has a pale cream ground colour with brown streaks and reticulations on the outside.

Hippeastrum Elwesii has been introduced into cultivation by Mr. H. J. Elwes, who found it himself near Lake Nahuel-Huapi, on the Rio Limay, in Argentina, in 1902. A plant brought to England by Mr. Elwes first flowered in his garden at Colesborne in September, 1903. It flowered again last year, when the plate, which was partly prepared from material supplied in 1903, was completed. The species is allied to *H. Ananuca*, Phil., from which it may be easily distinguished by its uniformly pale yellow perianth-lobes and the tube claret-coloured inside, while in *H. Ananuca* the lobes are yellow with vivid red midribs.

Phelipaea foliata is a handsome parasitic herb belonging to the *Orobanchaceae*, a native of the Crimea and Caucasus, its host always being *Centaurea dealbata*, Willd. It has numerous synonyms including *Orobanche coccinea*, M. Bieb. and *Anoplanthus coccineus*, Walp. The plant has been in cultivation for many years, at least as long ago as 1879, when its large bright scarlet flowers, which make a striking contrast to the silvery grey foliage of the host, were produced in the Imperial Botanic Garden, Petrograd. Seeds of the plants from which the material for the figure was obtained were received in 1911 from the Botanic Garden, Tiflis. and together with some of those of the *Centaurea* were sown in a pot. The seedlings of the host plant germinated in 1911, and were planted out in the Rock Garden later in the same year and grew alone till May, 1914, when the *Phelipaea* made its appearance.

The *Dorstenia* is a plant mainly of botanical interest and a native of the Belgian Congo, in some districts of which it is plentiful. It first appeared in Europe at the Colonial Garden, Laeken, near Brussels, and reached England in 1910, when a plant was exhibited at a meeting of the Royal Horticultural Society by Messrs. J. Veitch & Sons on behalf of the Director of the State Botanic Garden, Brussels. The plant was afterwards presented to Kew and was used in preparing the figure.

Marshall's Arbustum Americanum.—A copy of this rare work was presented to Kew in 1902 by the New York Botanical Garden. The title is "Arbustum Americanum: The American Grove, or an Alphabetical Catalogue of Forest Trees and Shrubs, natives of the American United States." The book was published at Philadelphia in 1775, and the Kew copy bears the number 2986. It is believed to be "the first truly indigenous botanical essay published in the Western Hemisphere,"* and forms a small octavo volume of nearly 200 pages. It was well received in Europe, and was translated into French and German in 1778. It contains

* Darlington, W. Memorials of John Bartram and Humphry Marshall, p. 489 (1849).

numerous new species, some of which have been omitted from the "Index Kewensis." The compilers of the Index do not appear to have seen the work, but to have taken up many of the new species at second-hand. The following are the species omitted from the "Index Kewensis." The six names preceded by a † have been adopted in Britton, Manual of the Flora of the Northern States and Canada, ed. 3 (1907), and in Britton and Brown, Illustrated Flora, ed. 2 (1913). *Corylus cornuta*, Marsh., is an earlier name for *C. rostrata*, Ait.; and *C. americana*, Marsh., replaces *C. americana*, Walt., which it antedates by three years. The remaining nine names appear to be synonyms.

†*Aesculus octandra*, Marsh. Arbust. 4 (1785); a prior name for *A. flava*, Ait.

†*Acer saccharum*, Marsh, l.c.; a prior name for *A. saccharinum*, Wangenh.

Andromeda plumata, Bartr. ex Marsh. l.c. 9; apparently a form of *Pieris nitida*, Benth. & Hook. f.

Aristolochia frutescens, Marsh. l.c. 12; a synonym of *A. macrophylla*, Lam.

†*Betula papyrifera*, Marsh. l.c. 19; a prior name for *B. papyracea*, Ait.

†*Betula populifolia*, Marsh. l.c.; a prior name for *B. populifolia*, Ait.

Betula humilis, Marsh. l.c.; possibly identical with *B. papyrifera*, var. *minor*, Tuckerm.

Corylus americana, *Marsh.* l.c. 37; a prior name for *C. americana*, Walt.

Corylus cornuta, *Marsh.* l.c.; a prior name for *C. rostrata*, Ait. Marshall evidently sent seeds or plants of the species to Europe, where it became known in gardens under the name "*C. cornuta*, Hort."—see advertisement on p. 170.

Hydrangea frutescens, Marsh. l.c. 61; a synonym of *H. arborescens*, Linn.

Juglans pecan, Marsh. l.c. 69; a synonym of *Hicoria pecan*, Britton.

Laurus geniculata, Marsh. l.c. 74; practically a nomen nudum; probably identical with *L. geniculata*, Walt., and therefore a synonym of *Glabraria geniculata*, Britton.

Ledum thymifolium, Marsh. l.c. 75; a synonym of *Dendrium buxifolium*, Desv.

†*Lonicera canadensis*, Bartr. ex Marsh. l.c. 81.

Mespilus apiifolia, Marsh. l.c. 89; a synonym of *Crataegus Marshallii*, Eggl. (*C. apiifolia*, *Mich.*).

Staphylea trifoliata, Marsh. l.c. 148; a variant of *S. trifolia*, Linn.

†*Taxus canadensis*, Marsh l.c. 150. T. A. S. AND M. L. G.

Triumfetta japonica.—Under this name Mr. T. Makino has recently described* a species from Japan and Corea which previous authors had identified with *T. trichoclada*, D.C., and *T.*

* Bot. Mag. Tokyo, 1913, vol. xxvii. p. 245.

annua, Linn. He states that it differs from *T. annua* in having hairy spines on the capsule, the leaves hairy on both surfaces, and the stipules and peduncles hairy; and from *T. trichoclada* in not having 7-nerved leaves and 4-sepalous calyx.

T. trichoclada, D.C. (*T. triclada*, Link) is, however, inseparable from *T. annua*, Linn.* The flowers of *Triumfetta* are usually pentamerous as regards the calax and corolla, but occasional tetramerous and hexamerous flowers have been observed along with pentamerous ones on the same specimen.† With regard to the characters in which *T. japonica* is stated to differ from *T. annua*, it should be noted that the latter also has hairy stipules and peduncles, and leaves bearing hairs on both surfaces. The remaining diagnostic character, the presence of hairs on the prickles of the capsule, is by itself hardly of specific value.

Judging from the description, *T. japonica* appears to be identical with *T. annua*, forma *piligera*, Sprague & Hutchinson, which differs from typical *T. annua* in having hairy prickles and fruit-body. This was recorded by the authors from Natal and Madagascar,‡ and has since been noted from Corea (*Faurie* 889 in Herb. Zürich) and the Philippine Islands (*Merrill* 4285). It was assigned the rank of a form rather than that of a variety chiefly on account of its sporadic distribution. Its synonymy and distribution are as follows: —

Triumfetta annua, forma **piligera,** *Sprague & Hutchinson* in Journ. Linn. Soc., Bot. vol. xxxix. p. 268 (1909).—*T. japonica*, Makino in Bot. Mag. Tokyo, 1913, vol. xxvii. p. 245.

Distrib. Natal, Madagascar, Philippine Islands, Corea, Japan. T. A. S.

Fomes juniperinus.—In the note on *Fomes juniperinus* published in *K.B.*, 1915, by an unfortunate oversight it is stated on p. 104 that Lloyd had recorded this species from Russia. The plant recorded by Lloyd is *Daedalea juniperina* (Murr.) P. Syd. Therefore the type of *F. Demidoffii*, which is probably the same as *F. juniperinus*, remains at present the only record from this region. E. M. W.

Flora Capensis.—The first part of vol. v. section 2 of this work has now appeared.

The families dealt with are the *Thymelaeaceae*, 181 species arranged in 12 genera, by Mr. C. H. Wright, the *Penaeaceae*, 24 species in 5 genera, and the *Geissolomaceae*, 1 monotypic genus, by Miss E. L. Stephens of Cape Town, the *Loranthaceae*, 42 species in 2 genera, by Mr. T. A. Sprague, and up to the 112th species of the genus *Thesium* in *Santalaceae*, by Mr. A. W. Hill, this last family being represented by 6 genera.

The Botanic Gardens, Dominica.—We welcome the Official Guide to the Botanic Gardens, Dominica, which has just been

* Journ. Linn. Soc., Bot., vol. xxxix. p. 268 (1909).
† l.c. 235.
‡ l.c. 269.

published. The Guide consists of some 44 pages, with map, illustrations and a useful index, and is full of interesting information about the numerous plants cultivated in the Gardens.

The area occupied by the Gardens and experiment grounds is now some 60 acres, 44 of which constitute the Garden proper. The present site was purchased in 1891, and the work of laying out the ground was commenced by Mr. H. F. Green, then curator, now in India. Since March, 1892, when Mr. Joseph Jones was appointed to the Curatorship from Kew, the Gardens have been continuously under his charge, and it is due to his skill and devotion that Dominica now possesses, for its size, one of the finest tropical botanic gardens in the world.

The Dominica Garden owes much to the beauty of its situation, but the remarkable interest of its collections, so well displayed in the Guide, is due to its Curator, with whose name it must always be associated.

In addition to the account of the Garden proper, the experiment grounds and nurseries, which form so important a feature of the work under the Curator's charge, are also shortly described. Here the limes, which may be said to have revolutionised the planting industry in Dominica, are being constantly raised and grafted and sent out to planters, as well as grafted cacao and mango, Pará rubber, vanilla, coffee, nutmegs, and other plants and trees of economic importance.

The Guide is a very readable work, and Mr. Jones is to be warmly congratulated on its production, more especially when it is remembered that it represents the results of the twenty-three years' loving service he has given, not to Dominica merely, but rather to the Empire in general.

Flora of the Kaikoura Mountains, New Zealand.—In a letter to the Director, Royal Botanic Gardens, Kew, dated Wellington, New Zealand, 29th April, 1915, Mr. B. C. Aston writes:—"I have recently begun the botanical exploration of a part of the Kaikoura Mountains (which go up to 9500 ft.) with gratifying results. The deep canyons of the limestone country have yielded (1) a new *Gentiana*, (2) the finest *Wahlenbergia* yet found in New Zealand, perennial and forming large masses of growth on the cliff faces, (3) a new *Carmichaelia*, and (4) some less interesting species; while the discovery of Kirk's *Olearia coriacea* in flower places that species in the section with *Olearia Forsteri*, the only other member of the genus having a single floret in each head, and supplies some additional evidence for the restoration of Forster's genus *Shawia*."